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Identification, Examination and Management of Risk Factors behind Dwelling Fires in The Kingdom of Saudi Arabia: A Managerial and Policy Perspective

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ABSTRACT

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Identification, Examination and Management of Risk Factors behind Dwelling Fires in the Kingdom of Saudi Arabia: A Managerial and Policy Perspective

Keywords: Fire hazard, dwelling fire, fire incidents, fire risk, risk management, socioeconomic factors, sustainability, civil defence authority perspective, Saudi Arabia.

Fire incidents are a central issue in Saudi civil defence. Despite detailed regulation concerning firefighting equipment dealing with dwelling fires, fires occur frequently.

Globally, research on dwelling fire safety is relatively new. Most studies focus on human factors, incidence and causal issues. Few studies examine management or policy-making perspectives towards managing these individual agents. Thus, a detailed study on understanding the management of these factors for dwelling fires is long overdue.

The study uses an inductive approach to investigate key management issues in reducing dwelling fires in Saudi Arabia. This qualitative study consisted of twelve in-depth semi-structured interviews and four focus groups with senior managers of the Civil Defence Division dealing with fire safety.

A sustainability-based framework is developed to map the critical issues in generating a long-term planning solution to policy and management of fire hazard and risk in Saudi Arabia. Critical drivers of this sustainability approach are good management, regulation, governance practices: especially accountability and transparency; reduction of tribalism, bureaucracy, and burns unit efficiency. However, given the modern environment of communications, information technology and communications, and in particular public education, are viewed as important mediators between drivers and sustainability. The critical role of knowledge generation is also positioned as a mediator.

The framework proposed is a paradigm shift from merely managing fire incidents on a case by case basis to a proactive risk reduction strategy. This represents an original solution to managing fire hazards at a national level and an important contribution to the fire management literature.

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CHAPTER ONE: INTRODUCTION AND BACKGROUND

This chapter provides an outline of the rest of this investigation and sets the context of the study. It provides the background of the study and provides the research aims and objectives which guide the rest of this study. It also provides the structure of this study, outlining each chapter and summarising the content and purpose of each.

1.1 INTRODUCTION

The issue of fire hazards remains a global phenomenon. No country is free from this problem, with estimates at anything between 7 and 9 million fires globally each year, almost one million suffering injuries and between 70 to 80 thousand dying in these fires (Brushlinsky et al., 2005). The majority of these fatalities occur in individual dwellings: indeed 80% of fire incidences occur in individual dwellings. Dwelling fires (causes, prevention, and management) are a global concern because such fires have the potential to compromise the integrity and the viability of the essential component of civilized society - the household. In turn, the weakening of the household compromises the society as a whole (Cote, 2004; Chhetri, Corcoran & Stimson, 2009; Furness & Muckett, 2007; Lowton, Laybourne, Whiting & Martin, 2010).

Although huge developments and strides have been made over the past few decades, especially with the advent of technological improvements in fire reduction capacity, despite these developments, major challenges remain. The lack of public education on fire safety, the lack of proactive government interventions, regulations and policies, the lack of basic fire safety services, especially in

developing nations, and the barrier of corruption and bureaucracy slowing progress even further are just a few of the salient issues. Furthermore, there is a chronic lack of research on effectively reducing fire risk and hazards from a management perspective. This study specifically deals with understanding the challenges for reducing fire hazards and risk within the Kingdom of Saudi Arabia.

1.2 BACKGROUND: THE SAUDI CONTEXT.

At the outset of the statement of the problem, it is important to clarify the issue of dates. Annual statistical data for Saudi Arabia is classified in accordance with the Hijri calendar, which is substantially different from the Gregorian calendar. Numerical designations of years differ, and the beginning time of years differs. Thus, as an example, Hijri year 1435 A.H. corresponds to the Gregorian period November 2013 to October 2014. For convenience in reporting the results of the investigation of dwelling fires in Saudi Arabia in this study, the annual data are identified by the latter year of the Gregorian calendar that is represented in the data. Thus, 1428 A.H. is reported as 2007.

Within Saudi Arabia, the total number of dwelling fires decreased 6.9% from 2007 to 2008 (Central Department of Statistics and Information, Government of the Kingdom of Saudi Arabia, 2008). From 2008 through 2012 however the number of dwelling fires in Saudi Arabia increased annually. The number of dwelling fires in Saudi Arabia in 2012 was 61.9% higher than the level in 2008 (Central Department of Statistics and Information, Government of the Kingdom of Saudi Arabia, 2008; 2010; 2012). Over this same period, the population of Saudi Arabia increased 19.1% (Central Department of Statistics and Information, Government of the Kingdom of

Saudi Arabia, 2008; 2010; 2012). Thus, the increase in dwelling fires cannot be explained only as the result of an increase in population.

Another important factor in relation to dwelling fires in Saudi Arabia is that the change in dwelling fire frequency from 2008 to 2012 was not the same across all administrative regions of the country. Increases occurred in nine of the 13 administrative regions, while decreases occurred in the remaining four administrative regions. There were also substantial dwelling fire frequencies per 1,000 population across the various administrative regions (Central Department of Statistics and Information, Government of the Kingdom of Saudi Arabia, 2008; 2010; 2012).

It is important to identify the causal factors that explain the changes in dwelling fire frequency in Saudi Arabia, as well as identifying the factors that explain the variations in the changes in dwelling fire frequency among the several administrative regions of the country. Socio-demographic characteristics, resident behaviours, resident knowledge and observance of fire safety procedures, building design, building codes and their enforcement, knowledge, competency, and performance of fire safety personnel and organizations all are potential causal factors for such fires (e.g. Pertschuk, Hobart, Paloma, Larkin & Balbach, 2013; Špatenková & Stein, 2010; Syphard, Bar Massada, Butsic & Keeley, 2013).

The issue of the fire service has now been discussed for decades in Saudi Arabia. Cities in Saudi Arabia have traditionally provided fire services through a diverse set of models. Traditionally, fire departments have been reluctant to embrace new methods of administration, because the potentially high price of failure is often overwhelming. As a line-operating agency, the fire service has traditionally been ill equipped in planning skills and organisation to undertake significant change.

However, increasing public demand for public services has pushed fire service administrators to look for tools to enable them to allocate scarce resources more effectively. In recent years, fire departments have turned to different tools and techniques to improve their in-house planning capabilities in Saudi Arabia. Previously, prior to the infusion of any new tools and methods into the fire service, administrators typically had to rely on outside agencies and consultants to complete the majority of their planning activities. The human capital simply was not available to perform these duties within the departments themselves. Moreover, the department were not focussing on identifying the root causes for an increased rate of dwelling fire and losses caused by fire.

The issue of allocating resources is the most basic issue that a fire department has to address in its planning process. Various models and factors need to be taken into account by fire service officials when allocating resources. Cities differ widely in their properties and in the demands they place on their emergency services. Clearly, it is impractical to rely on a specific resource allocation policy for all locales. Traditionally, fire service administrators allocated their resources based upon distance models. This was mainly due to the fact that analysis based upon distance was relatively easy to follow and complete. However, distance is not necessarily directly related to time, and when providing a service in which time is the critical factor, distance often proves to be an inadequate indicator of potential performance.

Fire services vary according to the fire-incident location in which they should be delivered: residential, commercial, or industrial areas. In these cases and with the exception of severe fire due to a natural calamity, e.g. mountain fires, fire

services should be regarded in terms of disaster-protecting emergency services. In the UK, systematic procedures have been developed to allow fire stations (brigades) to assess the various kinds of risk (individual, societal, property, heritage, and environmental) in their respective areas, and these are embodied in four toolkits covering the Fire Service Emergency Planning Process; dwellings, other buildings (shops, factories, offices etc.), special services and major incidents (The Home Office, 2000).

Fire services are provided mainly in the public domain by a fire department and the demanders can be either in the private or the public sector. In fact, the individuals who receive the benefits of fire services tend not to be responsible for paying taxes corresponding to the service supply costs. Although fire services differ according to the types of fire services, most are included in the public service sector. For these reasons they are often excluded from privatisation objects, in spite of recent trends, because it is considered that those services should be provided as fundamental national services, such as with military defence, police service and safety (security) service based on national or local (metropolitan or provincial) governmental taxes. Therefore, the provision of fire services tends to establish a supply system which places far more emphasis on equity than on efficiency.

Therefore, emergency services have been managed mainly in order to reduce the level of risk to the community from the occurrence of emergencies at local government level. More recently, for efficient management, the emergency services have tended to be provided in immediate response within the same service jurisdiction. However, disasters may take place beyond the boundaries of jurisdictional areas. This trend also reflects extremely broad service coverage, which

may be available by systematic location/allocation, resulting from technological or telecommunication skills: greatly improved equipment, computer-aided operating systems, precise mapping systems, remote surveillance and control systems, and so on. However, those technologies or skills may well contribute to improving the quality of emergency services. Management guidelines based on long-term planning should provide a response to any emergencies occurring in jurisdictional areas. In the case of critical disasters such as industrial fires, the even broader aspect of management guidelines may require an application to unexpected areas beyond the jurisdictional area.

The basic concepts for emergency/fire service and facilities depend on what methods/technologies are available, and how to manage the services efficiently and effectively based on criteria/standards. In Saudi Arabia, a great deal of investment has been made in terms of training, buying new systems and tools, new technologies, equipment etc. to improve the performance of the fire services. However, there is not sufficient research work to investigate how these new systems and tools are performing to reduce dwelling fires as well as their impact on Saudi society.

Hence, there is a major gap in the literature in the area of how a framework can be implemented in Saudi Arabia to improve the performance and effectiveness of the current procedures implemented in the fire department of the country. The findings of this study provide a sound basis for the development of effective and feasible recommendations for fire management authority actions that will lead to the reversal of the trend toward increasing frequency of dwelling fires in Saudi Arabia.

1.3 RESEARCH AIM AND OBJECTIVES

The broad aim of this study is *to deconstruct the fire risk management process in the Saudi context*. Understanding the key issues in this process is essential to help develop a national fire hazard policy. The investigation would therefore aim *to determine the key themes necessary to effectively manage the fire hazard process*. Furthermore, this study seeks the perspective of senior fire management staff who may be involved with or have experience of designing such interventions to improve the fire hazard process.

On a corresponding note, the research objectives decided upon are listed below:

- *Develop an understanding of the key management issues required for reducing fire risk or hazards in the Kingdom of Saudi Arabia.*
- *To determine if there is any relationship between the key management issues identified.*
- *To formulate a framework or conceptualise the process of managing fire hazards from a public policy perspective.*
- *To provide guidance based on the constructed framework for policy makers in the Kingdom of Saudi Arabia.*

Each aspect listed above is intended to draw attention to and explain the different parameters and aspects towards the developing an effective strategy to deal with fire hazards in the Kingdom of Saudi Arabia. The study takes certain practical measures and involves an inductive based approach to enable understanding and identification of core concepts. It is common knowledge that the

incidence of fire is not uniformly experienced across the Saudi Arabian population. It is also known that each year deadly fires break out in the Kingdom, resulting in heavy losses in life and property, and that not much consideration is paid to fire safety in buildings. A better understanding of management needs in reducing these fires however has never been explored in a Saudi context. Indeed, there has not been sufficient research conducted regarding how to reduce fire incidents as well as to explore the key factors that affect the dwelling fire.

This research therefore examines the identification of key issues, management or policy making, required to reduce the incidence of fire hazard and risk in the Kingdom of Saudi Arabia. The effects and implementation of the Saudi Arabia Building Fire Code are also examined in the literature review which follows this chapter. Likewise, the question of whether the models and techniques adopted in the Saudi Fire Code (2006) follow the pattern of developed countries, without out taking into consideration the specific socio-economic conditions in the Kingdom, will be explored.

The purpose of this research is thus to study and evaluate the issues needed for the better design and implementation of systems required to manage fire hazard and risk. The result of the study will allow the researcher to develop a framework to eventually reduce the number of dwelling fires as well as the impact of fire losses both from the preventive and reactive state of operations. Related to this, it will also aid the fire and emergency services to monitor their performance and create benchmarks for internal and external best practices. In addition, the results of this study should contribute to the improvement of the Saudi Arabian Fire Code. The

thesis is divided into several parts, with broad categories in the form of chapters to enhance easier synthesis of information.

1.4 PROPOSED RESEARCH METHODOLOGY

An inductive approach will be used to answer the above research questions. Qualitative data is collected through interviews and focus groups. The data is analysed using thematic analysis. A semi structured interview guide is used to elicit responses from senior members of the Civil Defence Division of the Kingdom of Saudi Arabia who are involved in the design and management of fire hazards. An inductive approach was selected and this rationale will be further described in the methodology chapter, but essentially, an inductive based approach is deemed most appropriate to uncover complex and deep rooted perceptions from individual informants. This is even more important given the lack of general research exploring the same research questions being addressed in this investigation.

1.5 STRUCTURE OF THESIS

Chapter 1: Introduction

The chapter begins by accepting the fact that fire-related burns have proved to be a serious matter and attempts to collate such incidences from existing statistics. The chapter gives the direction which the thesis will take in discussing the issue. It contains the thesis statement, rationale of the study, research questions and overall structure of the thesis

Chapter 2: Literature Review

This section of the thesis identifies several literatures each discussing a given component within the scope of the topic. The chapter analyses different views and propositions of varied authors while trying to establish objectives through the various research works conducted in other countries regarding fire prevention and reduction in dwelling fires. It has two components; one giving the stance of the authors and the second giving the writer's analysis of those research works. Chapter 3 is the backbone of this thesis as it concentrates on the subject of the study.

Chapter 3: Research Methodology

This is the foundation of the research, which shows the blueprint for the way in which this study has been conducted, along with a theoretical and philosophical justification for this. This study employs an inductive qualitative method, employing interviews and focus groups.

Chapter 4: Results and Findings

This chapter provides an overview of the key themes which emerged from the qualitative investigation. Furthermore, these themes are discussed using verbatim quotes to support observations. A theoretical conceptual framework linking the identified themes is formulated as the investigation's primary outcome. Contributions of the study are discussed in overview, as are managerial implications.

Chapter 5: Limitations, recommendations and conclusion.

This chapter concludes the thesis by firstly considering the limitations of the study. No study is without limitations and an overview of these is given here.

Following this, recommendations for further research are offered; and finally the study concludes with a synopsis of the entire study.

CHAPTER TWO: LITERATURE REVIEW

In this chapter, literature is reviewed which is relevant to the purpose of this study. The literature reviewed in relation to this topic is global in character as opposed to being specific to dwelling fires occurring within the Kingdom of Saudi Arabia (KSA). The globally-oriented character of the literature reviewed creates a framework within which the research performed in pursuit of the purpose of this study was conducted.

The findings of the literature review are presented in separate discussions related to the principal topic areas delineated in the preceding paragraph. The frequency of dwelling fires and the causal agents of such fires are addressed in the following section of this chapter. The prevention of fires in dwellings and the responses of fire safety organizations to dwelling fires are then presented in the subsequent two sections. In each topic area, relevant descriptive and theoretical literature is reviewed, as well relevant investigative research studies.

2.1 DISASTER MANAGEMENT IN THE KINGDOM OF SAUDI ARABIA

Before exploring fire risk management in the Kingdom, and the literature generally, an overview of studies on general disaster management in the Kingdom is conducted, since some studies have been done in this context which may provide a good background to issues affecting fire safety or what to expect from the respondents in the current study in relation to management of fire safety.

Effective disaster management relies on the preparation and training of first responders, but increasing emphasis is placed on the ability and capacity of

bystanders to provide initial first aid. This has been identified by the World Health Organisation (WHO) as a key strategy to effective disaster management. One study (Riad, Rabea & Badawy, 2013) found that there is a serious lack of disaster management at schools in Saudi Arabia, with most schools having no formal disaster management plan in place. Moreover, schoolteachers were often misinformed about appropriate and proper procedures to be followed in case of disaster. Recommendations for improving the situation in Saudi Arabian schools include better training by medical professionals, including nurses, to expand the capacity of schoolteachers to respond to incidents. Fire safety, including prevention and suppression systems as well as formal evacuation plans and drills, was also highlighted as being a key area of concern (Riad, Rabea & Badawy, 2013).

Furthermore, recognising that a disaster has occurred is the first step to responding effectively, but it is not always clear when an event moves from an ordinary occurrence to the level of disaster. Not making the determination that a disastrous event is underway delays effective response. That was the case in 1991 when an oil spill occurred off the coast of Saudi Arabia during the first Gulf War. Since that time, technology has improved significantly, to the point where satellite techniques can be used to identify oil spills and their expected effects. Deploying such a solution within Saudi Arabia would help the country effectively identify events that are likely to cause environmental impact, and to respond quickly to contain such disasters with minimal effect on the environment and population centres (Casciello, Lacava, Pergola & Tramutoli, 2011).

Petrochemicals are a critical part of the Saudi Arabian economy. Because the country has a large reserve of oil, extraction and related activities are a

significant part of the country's economy and commerce. However, this industry also has a high level of potential for disaster, with events such as oil spills, explosions and fires being common disaster occurrences within the industry. A study commissioned by the government of Saudi Arabia found that the nation lacks consistent standards with regard to the hazards posed by the petrochemical industry, and that there exists the potential for significant loss of property and life associated with a petrochemical disaster. Regional, national and infrastructure improvements were cited in this study as being critical to providing better and more effective disaster preparedness for these types of events (Al-Qahtani, 2014).

During the first Gulf War, an oil spill damaged the coast of Saudi Arabia, with loss of habitat for flora and fauna and impact on human inhabitants as well. Challenges in this situation were predicting the movement of the spill, the magnitude of the spill, and preventing ancillary damage that could have resulted from burning the oil as it came ashore as well as while it was at sea. Data acquisition is particularly difficult to accomplish at night, as oil and seawater can be difficult to differentiate. This greatly slows the response and the ability to direct inhabitants to safety. New monitoring techniques, built in part on information learned during the 1991 spill, can assist in evacuation and response strategies. A greater challenge remains in that individuals will need to be educated as to the warning system and the need to respond quickly. The response must also take into account containment and removal as well as evacuation and treatment of victims (Grimaldi et al., 2011).

When disaster managers engage in risk identification and planning, they often overlook the effects of fire events on responders, according to a recent study. Even small events can result in casualties that can quickly absorb available burn

resources. Disaster planners may make the mistake of assuming that most fire victims either die immediately or have only minor injuries. However, advances in fire fighting technology, rescue strategies and medical technologies have resulted in increased numbers of fire victims surviving with injuries that previously would not have been survivable. This can put significant strain on the response system, particularly in areas lacking large burn centres. Burn injury education thus needs to be expanded to include non-burn centre locations and providers, and more burn centres need to be built in areas that are currently lacking such facilities (Atiyeh & Dibo, 2013).

Burn victims who do not succumb to their injuries directly are highly susceptible to infection. Improperly coding burn victims and subsequent infections can result in higher mortality, according to a recent study. Because of this, it is incumbent on disaster managers that responders and providers are adequately trained in the proper coding of injuries and conditions. This aspect of care may be overlooked by disaster managers who focus on education and training that relates directly to the wounds and injuries suffered by victims, but recognising that communication among providers is increasingly dependent on technology, ensuring that patients are effectively "coded" into the system can be a critical step in their recovery and eventual re-entry back to society. This is true regardless of the source of the burn, but is particularly important when multiple victims are triaged at a single centre and then dispersed based on their injuries. Coding confusion in these cases can result in delay of care that can be critical (Saghaeiannejad, Enteshami, Kasaei & Shokrani, 2013).

The Kingdom has traditionally focused emergency management on mass religious gatherings, with particular emphasis on Hajj and the end of Ramadan. Crowd stampedes and medical issues have been a focus of this strategy, with some inroads (including helicopter availability to transport patients) being made. Such preparedness can be used for other emergencies occurring in the same region. There has been less successful planning toward motor vehicle crashes; while not properly considered disasters except on the rare large-scale occurrence, some of the infrastructure put into place to address these incidents benefits disaster preparedness by building up trauma centres and those trained to handle trauma. It is largely recognised, however, that a single significant event such as a fire or flood could easily overwhelm the ability of a region to address the disaster; this is made more likely by the lack of native Saudi personnel engaged in providing response. Often, the responders are expatriates or immigrants who not only may have difficulty communicating with victims, but who also repatriate their wages outside the country, which depletes the resources that are available to build up disaster response within the Kingdom (Alamri, 2010).

Early warning systems are key to ensuring minimal loss of life and property through prompt response. This can be particularly critical for natural disasters such as floods, and for fire events (whether natural or manmade). A study in Saudi Arabia found that disaster plans for single agencies tend to be lacking, and that multi-agency plans, which are critical to providing command and control as well as communication actions, are seriously underutilised in Saudi Arabia. Individual fire agencies, for example, have plans in place for dealing with isolated fire events, but do not have coordinated plans in place for larger events that may reach across

jurisdictions, or which occur on a large scale requiring coordinated responses across multiple agencies and providers (Zaboli, Seyedin & Malmoon, 2013).

Effective communication with the public and thus with potential victims is key to safeguarding and minimising the impact of disasters. This is true whether the disaster is widespread, such as a flood, or localised, such as a structure fire. Communication systems are being investigated by Saudi Arabia for implementation to provide data directly to the public regarding the location of an event, safe routes for evacuation, safe relocation centres, and similar information. While systems have not yet been deployed that make use of this technology in the Kingdom, they have been effectively utilised elsewhere. In order to maximise effectiveness, a single nationwide standard will need to be established so that individuals can receive appropriate warning even when they are outside their "home" area. Such systems are increasingly viewed as being critical parts of a successful disaster response strategy (Almagrabi, Loke & Torabi, 2012).

Although Saudi Arabia is often thought of as a desert country with a lack of rainfall, some areas are subject to severe floods that can cause significant loss of life and property. The country has recently begun investigating geographical information systems (GIS) in combination with wireless sensors for their usefulness for predicting flood damage. This can be particularly important in the Jeddah region, which is subject to flooding. A combination of topographical and watershed maps were incorporated into the GIS in order to provide multiple data sets that could then be analysed to determine potential disaster effects. Additional work has been done to analyse and predict flood potential in other areas with the intent of producing the

information necessary to develop flood response and evacuation plans (Ahmad et al., 2013).

In November 2009, a flood in the Jeddah region left more than 120 people dead and caused billions of dollars in damage and relocation costs. Research subsequent to the event determined that while the natural disaster was the root cause, the infrastructure and public policies in place were insufficient to handle a disaster of this magnitude. There was a lack of a formal disaster plan for either natural or manmade disasters, and a lack of accountability among government agencies that would be responsible for responding to such disasters. Calls for improving both the infrastructure and policy reform to address the systemic failures of the Jeddah flood response were made to avoid similar losses in the future (Momani & Fadil, 2010).

Natural disasters can be more devastating in areas where terrain is difficult. This is both due to the nature of the disaster, which can be more devastating, and to the difficulty of coordinating responses across challenging terrain. Developing accurate disaster prediction methods, including not only the type of disaster but the scope and likely areas to be impacted, can help respondents prepare disaster management plans that will offer the greatest response in terms of lives and property. Some recent work in Saudi Arabia has focused on combining satellites with high-altitude platforms (HAPs) to take full advantage of technology even when terrain would make more traditional land-based systems difficult to implement. There is a need for additional work in this area in order to develop comprehensive systems that can offer better disaster prediction (Albagory, Al Radaddy, Aljahdali & Said, 2014).

While remote sensing provides important data and can be particularly effective in the preparedness/warning and response/monitoring phases of disasters, there can be a tendency of disaster managers to rely too heavily on such sensing devices. A recent study indicates that remote sensing provides optimal results when used in conjunction with other surveying techniques, particularly GIS. In addition, the type of disaster must also be taken into account, so that remote sensing can be useful when identifying flood risks and severity, while far less effective in identifying other risks. It is also critical that data from remote sensing devices be effectively shared among those agencies that are responsible for disaster management; this sharing, in turn, requires common standards and application across disparate agencies and groups. Currently, this is considered a significant weakness in the ability of Saudi Arabia to identify and manage disasters (Bello & Aina, 2014).

Saudi Arabia is in the unique position of hosting millions of pilgrims each year to the cities of Makkah and Madina as part of the annual hajj. Human stampedes have occurred during the pilgrimage in the past, and the nation has taken steps to improve its ability to prevent, predict and respond to issues associated not only with stampedes, but also with other aspects of the overcrowding that the hajj brings. These include dehydration, heart attack and fatigue. Stampedes remain a key priority in assessing the risk of disasters associated with the mass gatherings that characterise hajj, and Saudi Arabia has taken a leadership position with regard to mass gatherings on an international level. Working with other countries, including India, where mass gatherings occur regularly and often within a religious context, Saudi Arabia has sought to mitigate the risk of human stampedes. However, progress in this area is generally recognised as slow moving and the challenge of stampedes remains an issue (Ngai et al., 2013).

Management information systems (MIS) can play an important role in disaster management in that such systems provide important control and command information while facilitating communications. While Saudi Arabia has implemented MIS across many different organisations at all levels of the public sector, the emphasis has been on MIS as an administrative tool. There has been a lack of focus toward developing MIS as a tool to support disaster management. As a result, MIS is generally considered underutilised in a disaster management setting with a resulting lack of coordination across organisations that would typically be involved in providing disaster services. Improving the implementation and deployment of standardised MIS across the country and throughout organisations at all levels will be essential to providing stronger disaster management services to the Kingdom (Al-Zhrani, 2010).

Increasingly, disasters are being defined not only as events that result in physical damage, but also as events that result in damage to infrastructure or commerce. One such attack occurred at the national oil company in Saudi Arabia in August 2012 when Aramco was the target of a cyber attack. More than 30,000 computers were damaged with the intent of disrupting the nation's oil and gas production. Such production is critical to the economy of Saudi Arabia and demonstrated the importance of maintaining strong defences against such attacks. Moreover, cyber attacks such as this can be used to disable disaster response capability so that more traditional attacks on infrastructure or specific physical targets can be launched. Recent research suggests that Saudi Arabia is vulnerable to these types of attacks and can significantly improve its self-protection in this area (Sheppard, Crannell & Moulton, 2013).

Nurses comprise one of the largest and most significant groups of providers in disaster response. A recent study indicates that the level of preparedness among nurses in Saudi Arabia is insufficient to meet the demands of a serious disaster. This lack of preparedness includes a lack of knowledge of disaster response strategies, lack of cohesive disaster plans that include nursing staffs, and lack of general knowledge of emergency preparedness techniques. Additional education and preparation of nursing staff is cited as being critical to the nation's ability to respond to disasters. In addition, the research also cites the importance of national standards to provide training and education framework for nurses as well as other medical professionals in disaster settings (Ibrahim, 2014).

Founded in 1969, the Organisational of Islamic Cooperation (OIC) is the one of the largest international organisations. With 57 members located in four continents, the OIC is the largest such organisation after the United Nations. The mission of the OIC is to promote and protect Muslim interests around the world, and in 2008, it created the International Cooperation and Humanitarian Affairs Department based in Jeddah. This department is dedicated to responding and offering material support to both member and non-member nations in times of disaster. This support is specifically not limited to disasters occurring within Saudi Arabia, but emphasises the importance both of international organisations as well as the need to coordinate the responses of such organisations (Ferris & Petz, 2013).

Disaster management inevitably contains ethical issues, whether determining how scarce resources are allocated during a disaster or determining which types of disasters are included in a disaster management plan. These considerations occur at the local, regional and national level, and may require coordination among multiple

agencies and organisations. In areas where natural disasters or wars are likely, international management strategies may need to be employed in order to address ethical as well as practical concerns. The International Red Cross and International Red Crescent both seek to avoid using humanitarian aid on any basis other than the need of individuals, families and communities, but political pressure can shift the allocation of resources. Saudi Arabia faces additional challenges because of the continued segregation of men and women in public settings, and the large numbers of expatriates who work in the country. In the event of a large disaster, determining who is evacuated, given priority for treatment and other relief determinations will raise ethical as well as practical challenges (Geale, 2012).

2.2 FIRE MANAGEMENT

Anthropological and archaeological evidence of the past suggests that mankind has been using fire for heat and light for over 500,000 years. The study of animal skins and woods indicates that humans may have used the embers from the natural burning fires for use in the camps. This enabled them to open a new territory by not only warding-off other competitors but also by enabling them to cook food (Diamantas, 2004). The harnessing of fire enables the development of human civilisation as it allows for the smelting of copper, tin, pottery and iron. It was the means by which humans evolved from creatures roaming in savannahs and fearing wild predators to build civilisation. However, as civilisation evolved, people began to live in close proximity and towns and cities grew, leading to the establishment of state and society. As trade and industry grew, fire became the necessary tool for heating, light, cooking and industrialisation and the risk of outbreaks of uncontrolled fire increased as a result. New and innovative tools were developed for the ignition of

fire, such as matches, which became the greatest innovation of history, and fire could be created instantly (Diamnatas, 2004).

However, the problem with this new technology, the match, was that sometimes the fire would escape from the users' control and would ignite a roaring fire that would destroy human dwellings and endanger peoples' very survival. Human society therefore developed methods and techniques to prevent this occurrence. In fact, the first known attempts at fire prevention and protection were undertaken by the Romans in around 300 BC; they created the first fire department in recorded history by organising fire fighting and night watch teams known as FAMILIA PUBLICA, which were later organized into a municipal fire department by Emperor Augustus, and laws were enacted against accidental or criminal ignition of fire, permitting corporal punishment for offenders (Diamantas, 2004; Cote, 2004).

In later times, the earliest attempt at preventing fire by regulating public behaviour was undertaken in London in 1066. William the Conqueror introduced a law that required all home owners to extinguish fire and cover the oven with an iron lid (Pearson, 1998). However, it was the Great Fire of London of 1666 which set in motion the changes that ultimately led to the organisation of fire fighting on organised, official lines. Medieval designs and wooden houses were replaced with brick and mortar houses and owners began to insure their house/property against fire damages. By 1700, insurance companies realised that big money could be made in fire fighting and obtained charters from the government. Similarly, new engines were introduced to reduce losses and men were hired from among the watermen who worked on the barges of the Thames. As each company was only interested in protecting their insured properties, a system of metal plates or markings was

introduced so that it was clear which houses were to be protected in the event of a fire. Consequently, there were instances when uninsured properties were allowed to burn down (Cote, 2004). Due to intense competition, these insurance companies began to merge and in 1833 those in London merged to form the London Fire Engine Establishment, and in 1850 advance thermal powered fire engines were introduced. By the early 20th Century however, most of the towns and cities already had either volunteer fire brigades or town fire brigades: hence it was only after a great deal of public commotion that all these brigades were amalgamated in 1938 and were unified under the Fire Service Act 1947 (fireservice.co.uk).

2.2.1 Defining Fire Safety

Defining fire safety is difficult and often results in a listing of factors that together comprise the intent. These factors tend to be of different sorts. Fire safety may be defined as goals and aims such as fire prevention, fire control, occupant protection, and so forth which normally can be found in the introductory sections of building codes and other fire safety legislation (Rasbash, et al., 2004). According to Howarth (1999, quoted by Derek & Chakib, 1999) fire safety management can be defined as the application by a manager of policy, standards, tools, information and practices to the task of analysing, evaluating and controlling fire safety.

The National Building Code of Canada (NRC, 1995) defines fire safety as “an objective to reduce the probability that a person in or adjacent to a building will be exposed to an unacceptable fire hazard as a result of the design and construction of the building.” According to Ramachandran (1999), safety is the complement or antithesis of risk. Safety will be increased if risk is reduced. There is no such thing as absolute safety, as some level of risk is virtually unavoidable. A building may be

considered to be 'very safe' from fire if a sufficiently 'low fire risk' is associated with its structure, contents and occupants'. Occupants play a vital role in lowering the fire risk if their behaviour during evacuation exactly follows the theoretical framework. But people's behaviour is sometime unpredictable and very complex. CWC (2000) states that fire safety is the reduction of potential for harm to life as a result of fire in buildings. Although the potential for being killed or injured in a fire cannot be completely eliminated, fire safety in a building can be achieved through proven building design features intended to minimise the risk of harm to people from fire to the greatest extent possible. Based on the Canadian experience, the number of deaths in building fires has significantly dropped for the last two decades mainly due to:

- Increased used of smoke detectors;
- Improvements in electrical and heating systems;
- Changing in life-style habits of habitants i.e. non-smoking, reduced alcohol consumption and dining out; and
- Public awareness, i.e. education programmes.

Failure to manage safety adequately often results in death or injury, chronic ill health and damage to property and/or the environment. Such results have a significant impact on the physical and economic well-being of society (Furness and Muckett, 2007).

2.3 FREQUENCY AND INCIDENCE PATTERNS

Concerns over the frequency of residential dwelling fires are global in character, as all countries and regions are detrimentally affected by such fires. Although the absolute frequency of such fires and the weighted frequency of residential dwelling fires (fire incidents per million population, as an example) vary by country-specific factors, research has found that spatial and temporal variations in fire frequency within countries occur (Corcoran, Higgs, Brunsdon & Ware, 2007; Špatenková & Stein, 2010). Based on data applicable to Wales in the United Kingdom, Corcoran, Higgs, Brunsdon and Ware (2007) found that the frequency of dwelling fires varied consistently by (a) hour of the day, (b) day of the week, and (c) month of the year, with higher frequencies (a) from 5PM to 8:30PM (lowest from 11:30PM to 12 Noon), (b) on Saturdays and Sundays, and (c) in March and April (lowest frequencies in December and January). Spatially, Corcoran, Higgs, Brunsdon and Ware (2007) found that, “21.8 percent of wards (containing 37 percent of the total population)” accounted for 50 percent of all dwelling fires (p. 527).

Špatenková and Stein (2010) examined data from Finland. They found that the highest frequencies of dwelling fires occurred (a) from 6PM to 11:39PM (lowest from 4AM to 8:30AM), (b) Saturdays through Tuesdays, and (c) in January and from March through July (lowest August and September). There are both similarities and differences between the findings of Špatenková and Stein (2010) and those of Corcoran, Higgs, Brunsdon and Ware (2007) with respect to the temporal frequency distribution of dwelling fires. The variations indicate the need to examine the experiences of each country independently.

Corcoran, Higgs, Rohde, and Chhetri (2011) analysed Australian-specific data, and included additional variables in their temporal analyses. With respect to differentiation between (a) school holidays, (b) public holidays, (c) long weekends and (d) so-called normal days, the per-day dwelling fire rates were (a) 4.2, (b) 2.8, (c) 3.0 and (d) 2.8. With respect to seasons of the year (and indirectly, mean prevailing outdoor temperatures), the per-day dwelling fire rates were (a) 2.6 summer, (b) 2.7 fall, (c) 3.2 winter, and (d) 2.8 spring (Corcoran, Higgs, Rohde & Chhetri, 2011).

With respect to spatial analysis of the frequency of dwelling fires, Špatenková and Stein (2010) measured fire frequency variations in relation to the population density of different areas of the country. The researchers found that dwelling fire frequency in high population density areas was 20 times greater than that in low population density areas, and seven times greater than that in medium population density areas (Špatenková & Stein, 2010). In part, this finding may be attributed to a weighted frequency measurement (incidents per capita); however, Špatenková and Stein (2010) found that the population/area-size ratio was the controlling variable.

Špatenková and Stein (2010) also examined variations in the frequency of dwelling fires in relation to socioeconomic factors. With respect to socioeconomic factors, Špatenková and Stein (2010) found that:

- The frequency of dwelling fires in buildings constructed before 1945 was 45 percent greater than in buildings constructed from 1945 to 1985, and 143% greater than buildings constructed after 1985. The finding was statistically significant.
- The frequency of dwelling fires consisting only of working-age adults was 12 times greater than in households comprised of working-age adults and children, and

2.5 times greater than in households comprised only of elderly adults. The finding was statistically significant.

- The frequency of dwelling fires in middle-income (€26,000-to-€46,000 annually) households was 2.5 times greater than that in high-income (more than €46,000) households, and three times greater than that in low-income (less than €26,000) households. The finding was statistically significant.
- The frequency of dwelling fires in low-education (50 percent or more of adult household members with only basic education) was 1.8 times greater than that in high-education households. The finding was statistically significant.
- The frequency of dwelling fires in high-unemployment areas (15.8 percent unemployment and higher) was 2.5 times greater than in low-unemployment areas. The finding was statistically significant.

An earlier study (National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency, 1997) based on data from the United States reported generalized findings that were compatible with the findings of Špatenková and Stein (2010). The findings of the earlier study, however, based the findings and conclusions on raw data that were not investigated through the application of formal quantitative analysis, and thus were not supported by any findings of statistical significance. More recent data from the United States indicate a decline in residential dwelling fires of 6.6 percent overall from 2007 to 2011 (National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency, 2013). From 2001 to 2010, the death rate (deaths per million population) from dwelling fires in the United States declined 21.2 percent. Over the same period, child death rates declined 40.6 percent, while fire death rates for older

adults declined 16.8 percent (National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency, 2013). The Department of Communities and Local Government, United Kingdom (2012) reported a three-percent decline in the number of residential dwelling fires from 2011-2012, with the number of dwelling fire deaths down 33.3 percent since 2001. These data from the United Kingdom and the United States are not directly relevant to the situation in the KSA; however, they do indicate that positive trends can be developed.

Corcoran, Higgs, Rohde and Chhetri (2011) developed Socio-Economic Index for Areas (SEIFA) scores for use in analysing Australian fire incident data. SEIFA scores are, “based on 21 census variables which are selected using a factor analysis” (Corcoran, Higgs, Rohde & Chhetri, 2011). The mean SEIFA score is 1,000, and higher SEIFA scores indicate a higher socio-economic level. Corcoran, Higgs, Rohde and Chhetri (2011) found that the mean SEIFA score where no dwelling fire occurred was 1,006, with a standard deviation of 89.27. Where dwelling fires did occur, the mean SEIFA score was 983, with a standard deviation of 92.89. Based on the testing of null hypotheses, Corcoran, Higgs, Rohde and Chhetri (2011) stated that the “implication is that for all fire types there is a notable decrease in fire risk for residents living in neighbourhoods with a SEIFA index of 1,100 or more” (p. 211).

2.4 CAUSAL AGENTS AND FACTORS

The Department of Communities and Local Government, United Kingdom (2012) classifies causal agents in terms of both (a) sources of ignition, (b) human factors versus non-human factors, and (c) accidental versus intentional fire starting.

Human factors involve primarily behaviours of dwelling residents with respect to accidental fires, and include such actions as (a) misuse of equipment, (b) placing articles and objects too close to sources of heat, and (c) playing with fire or playing with sources of ignition. Eleven sources of ignition are explicitly identified, and an “unspecified” classification also is included (p. 31). The eleven sources of ignition specified are as follows (Department of Communities and Local Government, United Kingdom, 2012, p. 31):

- Smokers’ materials; not including cigarette lighters or matches
- Cigarette lighters
- Matches
- Cooking appliances
- Space heating appliances; not including central heating appliances and water heating appliances
- Central heating appliances and water heating appliances
- Blowlamps, welding and cutting equipment
- Electrical distribution devices and lines
- Other electrical appliances
- Candles
- Other identified sources of ignition

In the United States, the National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency (2013) applies a causal classification system that includes both (a) sources of ignition and (b) the human factor/non-human factors dichotomy. The leading causes of residential dwelling fires are reported to be (a) cooking related, (b) heating related, (c) electrical malfunction, (d) other unintentional actions and/or factors, including carelessness, (e) intentional fire starting, and (f) the use of open flame (National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency, 2013). The National Fire Protection Association (NFPA), a non-governmental organization, also collects, analyses, and reports fire data in the United States. The NFPA reported the following causes of ignition in order of frequency for the 2007-2011 period (Ahrens, 2013):

- Cooking equipment (43%)
- Heating equipment (16%)
- Intentional fire starting (8%)
- Electrical distribution and/or lighting equipment (6%)
- Smoking materials (5%)
- Clothes dryer or washer (4%)
- Exposure to open flame (3%)
- Candles (3%)
- Playing with a heat source (2%)
- Other causes (10%)

The NFPA assessment further classified ignition causes for the 2007-2011 period in the United States. This classification specifically identified the role of behavioural actions by dwelling residents. The ignition causes, again in order of frequency, in this classification approach were as follows (Ahrens, 2013):

- Unintentional behavioural actions by dwelling residents (72%)
- Failure of equipment or heat source (14%)
- Intentional fire starting (8%)
- Unclassified causes of ignition (5%)
- Act of nature (1%)

The identification of the causes of ignition are important in efforts to enhance fire prevention. Additionally, however, it is important to identify the factors that contribute to ignition, if fire prevention efforts are to be optimally effective. Ahrens (2013) identified the contributing factors as follows, in the order of frequency:

- Unattended equipment (15%)
- Electrical failure or malfunction (13%)
- Heat source too close to combustibles (11%)
- Abandoned and discarded materials and items (11%)
- Failure to properly clean premises (8%)
- Unclassified misuse of material (8%)
- Unclassified contributing factors (7%)

- Mechanical failure or malfunction (7%)

Unintentional equipment turn-off or failure to turn-off (4%)

- Exposure to open flame (3%)
- Playing with heat source (2%)
- Unclassified operational deficiency (2%)
- Other known contributing factors (9%)

Some studies reported in the literature link socio-economic factors with residential dwelling fires in ways that infer casual effects of dwelling fire frequency (Corcoran, Higgs, Brunsdon & Ware, 2007; Lowton, Laybourne, Whiting & Martin, 2010; National Fire Data Center, United States Fire Administration, Federal Emergency Management Agency, 1997). In fact, however, the importance of socio-economic factors with respect to fire safety stems from the identification of the presence of these factors in a given situation, and, in turn, the usefulness of socio-economic characteristics as indicators of the probability of (a) occurrence of human behaviours that lead to residential dwelling fires and (b) the development of physical conditions that lead to and/or exacerbate to detrimental effects of residential dwelling fires. Thus, the greatest value of the knowledge of relevant socio-economic factors in relation to fire safety is the use of such knowledge in the development and implementation of residential dwelling fire prevention strategies, policies, and activities (Ramachandran, 2003; Schaenman, 2007; Silverman, Yin & Patterson, 2013).

2.5 PREVENTION OF FIRES IN DWELLINGS

Ahrens (2013) states that: “equipment and other product redesign, such as the ‘fire-safe’ cigarette which is designed to stop burning if not actively smoked, or automatic shut-offs on heating equipment, cooking equipment, or irons can mitigate human error and improve safety. Such changes may be the most effective and inexpensive approach to fire prevention” (p. iii). Certainly, such changes are vitally important; however, changing human behaviour relevant to fire safety also is important. Ahrens (2013) described in detail the effectiveness of smoke alarms is the detection of fires sufficiently early in the process to both facilitate controlling the progress of the fire, mitigating the damage of fire, and saving lives. Ahrens (2013) reported that in the United States during the 2007-2011 period, “smoke alarms were present in almost three-quarters (73%) of reported home fires and sounded in half (52%) of the home fires reported to U.S. fire departments” (p. i). Nevertheless, “three out of five home fire deaths resulted from fires in properties without working smoke alarms” (Ahrens, 2013, p. i). The problem was not needed improvements in smoke alarm technology. Rather, the problem centred around the (a) disabling of smoke alarms by dwelling residents because the alarms sounded while residents were cooking in an unsafe way or were engaging in other fire risk behaviours and (b) the absence of proper maintenance of smoke alarms to assure the devices were in working order (Ahrens, 2013). Lowton, Laybourne, Whiting and Martin (2010) conducted a study in the United Kingdom that found that smoke alarm problems were especially problematic for vulnerable old people because (a) many frequently cannot afford the cost of smoke alarms and (b) many find the maintenance requirements both daunting and expensive. The recommended solution, based on

the findings of “an in-depth falls risk, fear, and functional ability assessment” (Lowton, Laybourne, Whiting & Martin, 2010, p. 4), was that government should provide and maintain smoke alarms for vulnerable old people as an effective fire prevention strategy, and as a part of a comprehensive strategy for promoting the safety and wellbeing of the vulnerable elderly. In this instance, the recommendation was that the National Health Service and the Fire and Rescue Services jointly implement such a strategy.

Saramago, Cooper, Sutton, Hayes, Dunn, Manca and Kendrick (2014) conducted a study to assess the cost-effectiveness of increasing the presence of smoke alarms in households that include pre-school children. The study was prompted in part by data indicating that the “UK has one of the highest rates for fire deaths from fire and flames in children aged 0-14 compared to other high income countries” (Saramago et al., 2014, p. 64). The conclusion drawn by the study’s authors was that a combination of (a) education and (b) free or low-cost smoke alarm equipment was “the most cost-effective intervention” for addressing the problem (Saramago et al., 2014, p. 75).

Another active fire counter-measure, of which smoke alarms are an example, is the installation of sprinkler systems in residential dwellings. The Fire Sprinkler Association (2004) in the United Kingdom conducted an assessment of a study of sprinkler effectiveness on residential dwellings. The conclusion drawn from the findings of the assessment was that the findings in the report indicating that residential sprinklers were not cost-effective were flawed. The Fire Sprinkler Association (2004) assessment included information indicating that: “The cities of Scottsdale, Arizona, USA and Vancouver, British Columbia, Canada have both

adopted legislation requiring sprinklers to be fitted in all new buildings, whether residential or commercial” (p. 3). It was noted in the assessment that each city had, at the time of the assessment (2004), excellent experience related to the sprinkler requirement (20 years for Scottsdale and 15 years for Vancouver). While this assessment was performed by an industry association (and might be expected to place a positive spin on sprinkler fire safety effectiveness and cost-effectiveness), the positive impacts of sprinklers in residential dwellings has been supported by unbiased research.

A later assessment by Fraser-Mitchell and Williams (2012) that was prepared for BRE Global, the organization that presented the 2004 cost-benefit analysis assessed by the Fire Sprinkler Association (2004), included findings supporting conclusions that: “residential sprinklers are cost-effective for:

- all residential care homes for elderly people, children and disabled people (including those with single bedrooms).
- Most blocks of purpose built flats and larger flats ... where costs are shared.
- Traditional bedsit type HMOs where there are at least six bedsit units per building and the costs are shared” (Fraser-Mitchell & Williams, 2012, p. 59).

In the United States, the Fire Protection Research Foundation (2010) examined the increasing use of incentives provided to residential property owners to install sprinkler systems in residential dwellings. The findings of the report supported (a) effectiveness of sprinkler systems in enhancing fire safety in residential buildings and (b) effectiveness of monetary incentives to install sprinkler systems. Incentive values were found to be higher for builders and developers than for homeowners.

Garis and Clare (2013) conducted a study that compared fire outcomes differentiated by residential buildings with and without sprinkler systems. The researchers found that fires in residential buildings without sprinkler systems accounted for 91.3% of residential fires, 94.1% of injuries resulting from residential fires, and 99.3% of deaths resulting from residential fires: “Less than 1% of fires in single detached residential properties occurred in the presence of sprinkler protection” (Gris & Clare, 2013, p. 1). Further, the absence of sprinkler systems in residential buildings was associated with fire-related death rates per 1,000 fires 13.7 times as high as the rate for dwellings with sprinkler systems (Gris & Clare, 2013). Other recommended improvements for incorporation into residential building codes designed to improve residential dwelling fire prevention and safety include:

- Flame retardants in building insulation (Babrauskas, Lucas, Eisenberg, Singla, Dedeo & Blum, 2012)
- Improved standards for engineered wood, which has been found to be less resistant to fire spread than conventional wood and less structurally stable in fire conditions (Izydorek, Zeeveld, Samuels & Smyser, 2009; Tabaddor, 2008)

Behavioural modifications that are promoted include, prominently, reductions in smoking behaviours in residential dwellings, even to the point of creating smoke-free multi-unit housing complexes. Another behavioural modification recommended is the regular performance of household fire drills.

2.6 INCIDENCE AND CAUSAL FACTORS FOR KINGDOM OF SAUDI ARABIA

There are relatively few studies reported in the literature that focus specifically on dwelling fires occurring within the KSA. Al-Homoud and Khan (2004) conducted a study that assessed safety measures in residential buildings in the KSA. This study was conducted in 2004 and relied on data from the inclusive four-year period 1996-1999. During the 1996-1999 period, dwelling fires accounted for 69% of all building fires reported in the KSA. The researchers conducted a survey that found that, “most residents” were “ignorant” with respect to fire safety risks present in their dwellings (Al-Homoud & Khan, 2004, p. 300). The study also included a safety audit of a small sample of dwelling buildings that found four deficiencies in building design and building operation with respect to fire safety and fire prevention. With respect to causal factors of dwelling fires over the 1996-1999 period, electrical faults and the behaviours of children were the leading causes, 37% and 36%, respectively of total dwelling fires.

In 2004 also, Al-Homoud, Abdou, and Khan (2004) conducted a study that focused on safety design practices for residential structures in the KSA. The study focused on (a) safety codes, (b) organizational responsibility for the review and approval of safety practices, and (c) dwelling building design with specifically targeting the number of units in a dwelling structure and the height of a dwelling building. The study indicated that “no specific safety code was used by designers of residential buildings” in the KSA, and that most designers were “not aware of the regulations” regarding fire safety that were in effect (Al-Homoud, Abdou & Khan, 2004, p. 541). The study findings also indicated that organizations responsible for

the review and approval of safety requirements “did not require the submission of safety” measures by building designers (Al-Homoud, Abdou & Khan, 2004, p. 541).

Since recent data in incidences and causal factors for the Kingdom of Saudi Arabia have not been published, internal records from the offices of the Central Department Statistics and Information Civil Defence Authority are tabulated to generate incidence and causality tables presented in this section. Although this is not the focus of this investigation, this tabulation represents a contribution to the literature in its own right since this is the first time to date these data have been tabulated and published.

The frequency of dwelling fires in the KSA for the inclusive period 2008 – 2012 was examined with respect to three investigative foci. The specific foci were; (a) variations in frequency across years, (b) variations in frequency by month of the year, and (c) variations in frequency by sources of ignition.

Data on dwelling fire frequencies by year and by month of the year for the inclusive period 2008 – 2012 are presented in tabular form in Table 2.1., which may be found on the following page. As the data presented in Table 2.1. indicate, the total number of dwelling fires occurring on an annual basis in the KSA increased from 7,427 fire incidents in 2008 to 13,346 fire incidents in 2012; an increase in the annual number of dwelling fire incidents in the KSA of 79.7% over the five-year span. Part of this increase in the annual number of dwelling fire incidents is attributable to population increases in the KSA over the 2008 – 2012 period (refer to Table 2.2, which may be found on the following page). As the data presented in Table 2.2 indicate, the population of the KSA increased 28.7% from 2008 to 2012. Obviously, other explanatory factors were involved in the increase in annual dwelling fire

incidents. One answer to this situation emerged when the annual frequency of dwelling fires in the KSA was measured in relation to the population of the country. The measure derived was dwelling fire incidents per 100,000 population.

TABLE 2.1 – DWELLING FIRES BY MONTH AND YEAR

KSA Dwelling Fires by Year & Month					
	2008	2009	2010	2011	2012
Month	1429	1430	1431	1432	1433
Muharram	546	633	627	857	1115
Safar	589	705	657	908	839
Rabi I	602	725	673	944	852
Rabi II	665	661	651	862	1017
Jumada I	708	780	692	761	970
Jumada II	743	1009	814	1124	1241
Rajab	746	871	1050	1246	1350
Sha'aban	655	847	889	1315	1269
Ramadhan	563	724	848	1119	1302
Shawwal	589	801	861	1193	1235
Dhul Qidhah	479	576	797	992	1154
Dhul Hijja	542	606	735	896	1002
Total	<u>7427</u>	<u>8937</u>	<u>9296</u>	<u>12216</u>	<u>13346</u>

Source: Central Department Statistics and Information, 2012, 2010, 2008.

Table 2.2 – KSA Population by Year and Administrative Region

KSA Population by Year & Region					
	2008	2009	2010	2011	2012
Region	1429	1430	1431	1432	1433
Riyadh	5458273	6117710	6777146	7043556	7309966
Makkah	5797184	6356095	6915006	7193491	7471975
Madinah	1512724	1645329	1777933	1844466	1910998
Al-Qaseem	1015972	1115915	1215858	1259741	1303623
Eastern	3360031	3732906	4105780	4260029	4414278
Assir	1687939	1800666	1913392	1979231	2045070
Tabouk	691716	741626	791535	818696	845857
Hail	526882	562013	597144	617922	638699
Northern Border	279971	300248	320524	331511	342498
Jazan	1187587	1276349	1365110	1412825	1460540
Najran	420345	462999	505652	523498	541344
Al-Baha	377900	394894	411888	425908	439927
Al-Jouf	361738	400874	440009	455565	471120
Total	22678262	24907620	27136977	28166436	29195895

Source: Central Department Statistics and Information, 2012, 2010, 2008.

Dwelling fire frequency rates per 100,000 population for the period by year and month of year are presented in tabular form in Table 2.3, which may be found on page 49. With respect to months of the year, the Islamic Hijri calendar used in Saudi Arabia is a 12-month calendar, as is the Gregorian calendar used in Western nations. The lengths of months, however, varies between the two systems. Thus, as noted in the Problem Statement in Chapter 1 of this study, it is feasible to use the Gregorian designations of years for the inclusive period 2008 – 2012 in this study, although there are minor (a few days') variances. It is not feasible, however, to use Gregorian designations for months of the year. As an example, December of 2008 covers 28 of the 30 days of the month of Dhul Hijja and three of the 29 days of the month of Muharram. December 0f 2012, however, covers 13 of the 29 days of Muharram and 18 of the 30 days of the month of Safar. Thus, in this study, monthly data are reported according to the Hijri calendar months. Gregorian/Hijri calendar

correlations by month for the inclusive period 2008 – 2012 may be found at: <<http://islamicfinder.org/Hcal/calendar>>.

As the data presented in Table 2.3 indicate, dwelling fires in the KSA increased from 32.75 dwelling fire incidents per 100,000 population in 2008 to 45.71 dwelling fire incidents per 100,000 population in 2012. Over the five-year span the annual rate per 100,000 population increased 39.6%. The increase in the rate was not steady, however, as the rate per 100,000 population decreased slightly in 2010 before climbing again in 2011

Table 2.3 – Dwelling Fires per 100,000 Population by Month and Year

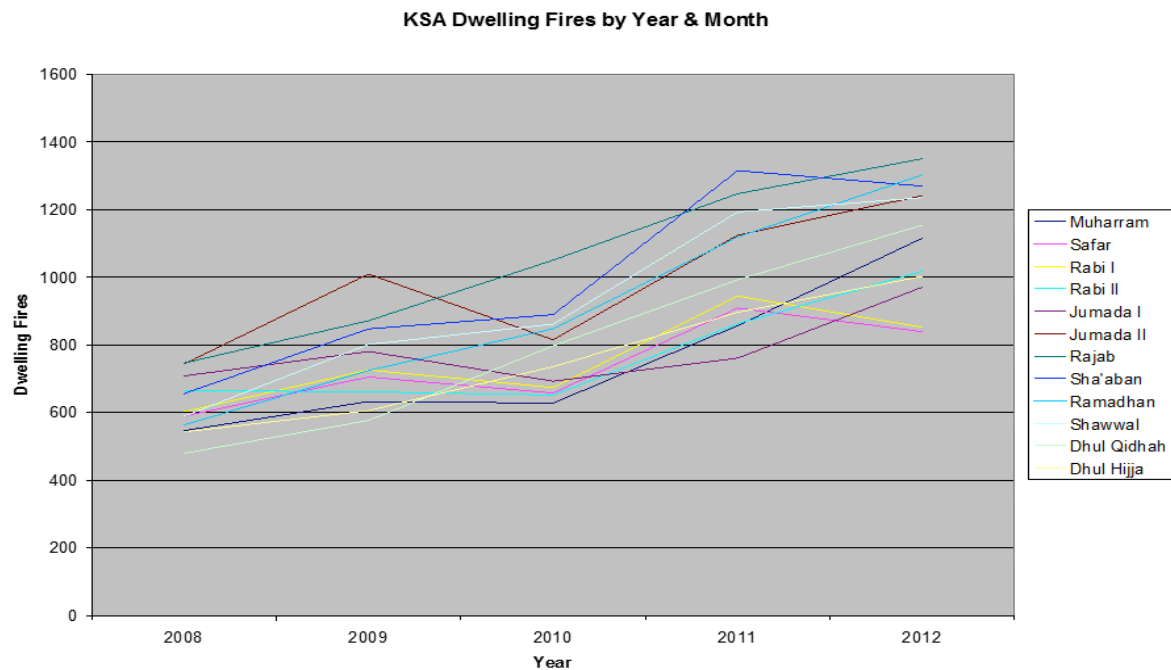
KSA Dwelling Fires Per 100,000 Population by Year & Month					
	2008	2009	2010	2011	2012
Month	1429	1430	1431	1432	1433
Muharram	2.41	2.54	2.31	3.04	3.82
Safar	2.60	2.83	2.42	3.22	2.87
Rabi I	2.65	2.91	2.48	3.35	2.92
Rabi II	2.93	2.65	2.40	3.06	3.48
Jumada I	3.12	3.13	2.55	2.70	3.32
Jumada II	3.28	4.05	3.00	3.99	4.25
Rajab	3.29	3.50	3.87	4.43	4.62
Sha'aban	2.89	3.40	3.28	4.67	4.35
Ramadhan	2.48	2.91	3.12	3.97	4.46
Shawwal	2.60	3.22	3.17	4.23	4.23
Dhul Qidhah	2.11	2.31	2.94	3.52	3.95
Dhul Hijja	2.39	2.43	2.71	3.18	3.43
Total	32.75	35.88	34.25	43.37	45.71

Source: Calculated from data obtained from Central Department of Statistics and Information, 2012, 2010, 2008.

The monthly patterns of dwelling fire incidents over the 2008 – 2012 period are illustrated in Chart 2.1, which may be found below on this page. The patterns for seven of the 12 months reflected a steady increase from 2008 to 2012.

The patterns for Safar, Rabi I, Rabi II, Jumada I, and Jumada II; however, varied from the steady growth pattern.

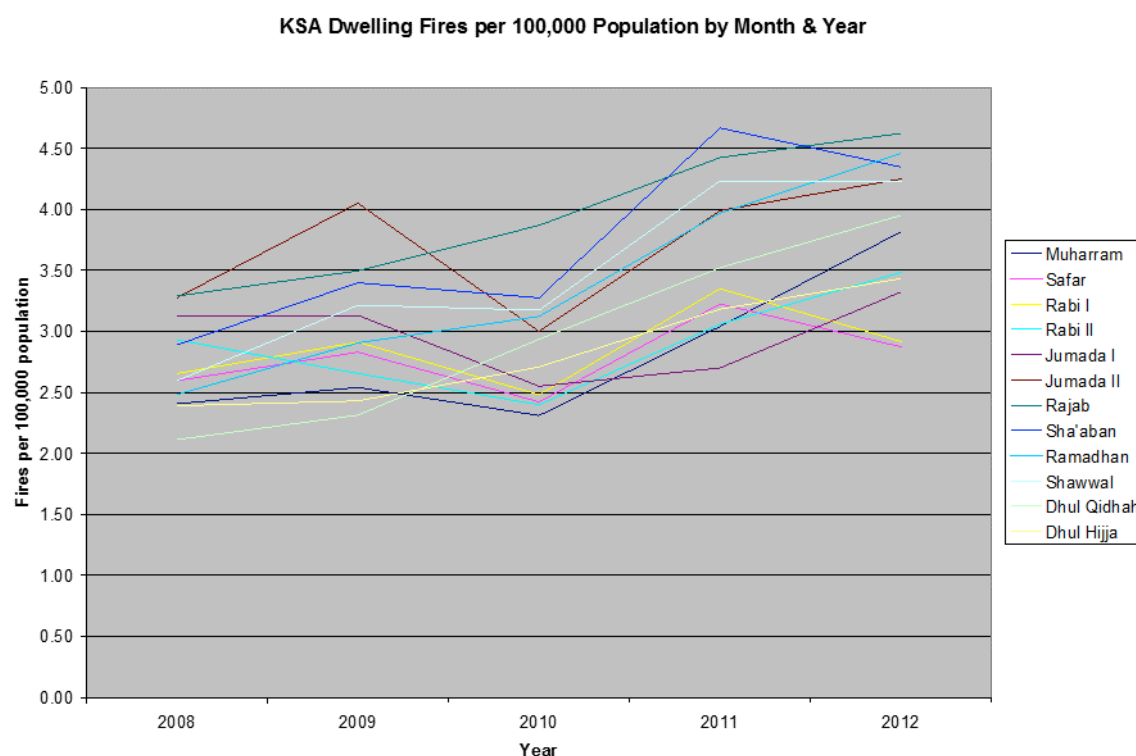
Chart 2.1 – KSA Dwelling Fire Patterns by Month and Year



Source: Constructed from data obtained from Central Department of Statistics and Information, 2012, 2010, 2008.

When the frequency of dwelling fire incidents per 100,000 were examined, however the steady growth pattern applied to only four months – Rajab, Shawwal, Dhul Qidhah, and Dhul Hijja (refer to Chart 2.2, which may be found below on this page).

Chart 2.2 – Patterns - Dwelling Fires per 100,000 Population by Month and Year



The frequency of dwelling fires in the KSA were also examined with respect to causal factors (sources of ignition). The data relevant to total dwelling fires per year, categorized by causal (ignition) factor, are presented in Table 2.4, which may be found on this page. Data relevant to dwelling fires by year and causal sources per 100,000 population are presented in Table 2.4.

Table 2.4 – KSA Dwelling Fire Frequencies per Year and Causal Factor (Source of Ignition): 2008-2012

KSA Dwelling Fires by Year & Causal Factor					
	2008	2009	2010	2011	2012
Causal Factor	1429	1430	1431	1432	1433
Electrical	3650	4840	5196	7102	7612
Children	1685	1970	1871	2168	2090
Heating	747	746	711	863	996
Cooking	939	953	1058	1366	1513
Flammable Liquids	56	44	48	105	96
Natural Gas	16	26	25	30	23
Chemical Reaction	4	5	9	8	12
Vehicular	12	13	10	5	3
Weather	19	35	26	72	25
Waste Disposal	103	69	88	116	112
Criminal Act	188	215	201	219	265
Other Known	8	21	49	156	328
Undetermined	0	0	4	6	271
Total	<u>7427</u>	<u>8937</u>	<u>9296</u>	<u>12216</u>	<u>13346</u>

Source: Central Department Statistics and Information, 2012, 2010, 2008.

As the data presented in Table 2.4 indicate, the most dramatic increase in annual dwelling fire frequency with respect to causal factors was with respect to electrical faults and/or misuse which increased 108.5% from 2008 to 2012. Cooking-related dwelling fires stated in annual terms increased 61.1% from 2008 to 2012. In terms of sheer numbers of fires, electrical-related causes accounted for 57% of all dwelling fires in 2012, while the second highest causal factor was children playing with ignition sources, which was responsible for 15.7% of all dwelling fires in 2012. The importance of electrical-related dwelling fires is of great concern, as such fires accounted for more than 50% of all dwelling fires in the KSA in each year from 2008 to 2012.

Table 2.5 – KSA Dwelling Fire Frequencies per 100,000 Population by Year and Causal Factor (Source of Ignition): 2008-2012

KSA Dwelling Fires Per 100,000 Population by Year & Cause					
	2008	2009	2010	2011	2012
Cause	1429	1430	1431	1432	1433
Electrical	16.09	19.43	19.15	25.21	26.07
Children	7.43	7.91	6.89	7.70	7.16
Heating	3.29	3.00	2.62	3.06	3.41
Cooking	4.14	3.83	3.90	4.85	5.18
Flammable Liquids	0.25	0.18	0.18	0.37	0.33
Natural Gas	0.07	0.10	0.09	0.11	0.08
Chemical Reaction	0.02	0.02	0.03	0.03	0.04
Vehicular	0.05	0.05	0.04	0.02	0.01
Weather	0.08	0.14	0.10	0.26	0.09
Waste Disposal	0.45	0.28	0.32	0.41	0.38
Criminal Act	0.83	0.86	0.74	0.78	0.91
Other Known	0.04	0.08	0.18	0.55	1.12
Undetermined	0.00	0.00	0.01	0.02	0.93
Total	32.75	35.88	34.26	43.37	45.71

Source: Calculated from data obtained from Central Department of Statistics and Information, 2012, 2010, 2008.

2.7 ORGANIZATIONAL RESPONSES TO DWELLING FIRES

The principal focus of the review of literature relevant to responses to residential dwelling fires by fire safety organizations is on management issues and practices. These issues and practices cover a wide spectrum of responsibilities and activities that include strategic planning, tactical planning, resource use, fire fighting and rescue, and fire prevention education and promotion. In the KSA, these responsibilities are under the general management of the General Directorate for Civil Defence (GDCCD). The GDCCD develops high level policies and strategies that are interpreted and implemented at the administrative division level of governance in the KSA.

One important tactical planning step for fire fighting and rescue operations is the creation of an incident command system (ICS) that is activated during fire emergency operations to “assemble and control the temporary systems” that are “deployed to manage personnel and equipment” when responding to fire emergency situations (Bigley & Roberts, 2001, p. 1282). Somewhat less extensive command structures are formed when responding to more localized fire incidents; however, formal rules of operation and engagement apply in all cases. The study conducted by Bigley and Roberts (2001) found that the ICS model allows fire safety organizations to “respond reliably to dynamic, unpredictable, and hazardous working conditions” (p. 1292). Crew size and fire service arrival times have been found to have substantial and significant effects on fire outcomes. Four-person crews, as an example, “complete essential fire fighting and rescue tasks in a typical residential structure 30% faster than two-person crews and 25% faster than three-person crews” (National Institute of Standards and Technology, 2010, p. 9). The ICS model enables the resources necessary for such responses.

A critical strategic function that must be addressed effectively by fire safety organizations is the performance of a risk assessment analysis in conjunction with the development and implementation of a detailed strategic plan to address effectively the issues identified through the conduct of the risk assessment analysis. The critical elements of this approach to strategic planning by fire safety organizations are as follows (Department of Communities and Local Government, United Kingdom, 2006):

- Identify fire hazards
- Identify population groups at risk

- Evaluate fire hazards and risk groups to develop plans of action to protect population groups at risk from fire hazards
- Develop and initiate plans to inform and educate population groups at risk on fire prevention and fire safety issues
- Develop and initiate plans to inform, instruct, and train fire safety organizations and personnel on organizational responses to fire emergencies
- Develop and initiate plans to identify, obtain, station, and effectively deploy essential resources in the pursuit of fire safety

The actions delineated in the preceding discussion must be followed by the development, implementation, monitoring, review, and adjustment (as necessary) of strategic action plans. Action plans must include performance objectives, time-delineated target performance goals, and contingency plans (Ramachandran, 2003). Resource planning also is a vital component of strategic planning. In relation to fire safety organizations, a crucial resource is water. The design and functioning of water distribution systems in fire safety organization areas of responsibility must aim toward: “(a) minimizing potential fire damage, (b) minimizing water quality deficiencies, and (c) minimizing the cost of mitigation” (Kanta, Zechman & Brumbelow, 2012, p. 144).

Schaenman (2007) examined best practices by fire safety and rescue service organizations in the United Kingdom (England and Scotland) and in Scandinavia (Sweden and Norway) with respect to residential dwelling fires. There are both similarities and differences between the two sets of best practices. A summary review of the two sets of practices is presented below (Schaenman, 2007):

- Risk Analysis

England & Scotland: Local fire safety organizations use national risk analysis software linking fire and socio-economic data to predict high-risk areas and to target high-risk population groups to strategies optimizing prevention and suppression

Sweden & Norway: Risk analysis responsibility is placed on building owners, who are charged with ensuring the safety of their property.

- Fire Service Staffing and Training for Prevention

England & Scotland: Prevention is a primary service, as opposed to a support service; response time standards are set by local fire safety organizations to permit local optimization of fire fighting and fire prevention

Sweden & Norway: Strong emphasis is placed on education and training for risk identification and fire prevention

- Home Safety Visits

England & Scotland: Primary focus on high-risk residential dwellings; visits include smoke alarm inspection, hazard inspection and mitigation, and resident education; safety specialists have foreign language skills, training in dealing with the elderly, substance abusers, and hearing and/or mobility impaired persons

Sweden & Norway: Dwellings with chimneys must be inspected by licensed fire inspectors; inspection frequency required depends on usage and varies from 4 times per year to once every four years; home inspectors check heating systems

- Fire Safety Campaigns

England & Scotland: National and local campaigns are conducted through paid prime-time television and radio spots; public service spots in non-prime time hours are not used; ethnic population are targeted as well as dominant population groups

Sweden & Norway: Safety calendars are distributed to Swedish school children; Swedish Fire service trains school students to inspect their homes; fire safety service conducts a Safe Home campaign directed at builders.

- Employee Safety Education

England & Scotland: No programme

Sweden & Norway: Fire safety organizations provide fire safety and prevention education to workers at places of employment for application at work and at home

- School and Youth Programmes

England & Scotland: fire safety and prevention programs reach all elementary students and a high proportion of secondary students; special programs target youth who have exhibited anti-social behaviours such as fire-setting and vandalism

Sweden & Norway: fire safety and prevention programs reach all students twice over the span of their years in school

- Programmes for the Elderly

England & Scotland: social service caretakers for the elderly are trained in fire safety and prevention; fire service organizations visit high-risk elderly persons in their dwellings

Sweden & Norway: Fire service organizations provide fire safety and prevention education to caretakers for elderly persons; fire resistant “smokers’ aprons” are provided to elderly persons who smoke (Schaenman, 2007, p. 25)

- Home Fire Extinguishers

England & Scotland: No legal requirement or programme

Sweden & Norway: Norway requires fire extinguishers and/or hoselines attached to faucets in each dwelling; occupants are trained by fire service personnel in the use of fire extinguishers.

- Safer Products for the Home

England & Scotland: Advanced smoke alarms (tamper-proof, battery-powered, 10-year life are installed by fire safety organizations, and are also available for purchase; hard-wired smoke alarms are required in all new residential dwelling construction, as well as in major remodelling of existing dwellings; flame-resistant and cigarette-resistant upholstered furniture and bedding are required by law; portable sprinkler systems are provided for high-risk households

Sweden & Norway: Timers are required in cooking appliances to automatically shut-off appliances if left unattended or if occupants forget and go to sleep; fire service organizations recommend that electrical equipment be plugged in to power-strips and turned-off at night if unneeded; use of safety-candles is promoted

- Inflatable Cushions for Jumpers

England & Scotland: No programme

Sweden & Norway: Norway provides all fire safety organizations with “large, rapidly-inflatable cushions” for use in the rescue of persons up to the level of four floors (Schaenman, 2007, p. xi)

- Community Fire Stations

England & Scotland: All new fire stations are designed to serve as community fire safety centres as well as functional fire stations; the safety centre component provides fire safety literature, “live-fire demonstrations, and viewing areas to observe fire fighter training and response (Schaenman, 2007, p. viii)

Sweden & Norway: No programme

2.8 RESEARCH ON EVACUATION FROM THE BUILDING

Jones and Hewitt (1986) studied group formation and leadership during evacuation of a high-rise office building due to fire. They focus on the social context and organisational characteristics of occupancy, within which were decisions about evacuation strategy, group formation and questions of leadership. Horiuchi et al. (1986) studied the effects of fire and evacuation from a multi-purpose office building in Osaka, Japan. Sekizawa et al. (2001) studied the feasibility of evacuation by elevators in high-rise building. Benthorn and Frantzich (1998) studied how people evaluate the information and choose the evacuation exit when the fire alarm goes off in a public building. Kagawa et al. (1986) studied the movement of people on stairs in high-rise office building in Japan. Shields and Boyce (2000) studied the evacuation from a large retail store and among the findings was that 50.1% chose the nearest exit to evacuate from the building and 19.5% chose a familiar exit to

evacuate from the building. Shields et al. (1998) studied the behaviour and characteristics of people in unannounced fire drills at large retail stores.

Purser (1986) studied the effect of fire products on escape capability using primates and human fire victims. Beller and Watts (1998) took a human behaviour approach to occupancy classification. They suggested that there are four categories of occupants' data that are necessary to implement a performance approach to life safety, i.e. location of occupants with regard to the allowable minimum travel distance, occupants' response to fire, number of occupants, and staff training. Galina and Mutani (1998) studied fire safety aspects in historical buildings reused as libraries and evacuation in Italy.

Proulx (2001) studied the possibility of adopting a stay-in-place procedure during high-rise building fire. She suggested that stay-in-place is appropriate for high rise residential, hotel, and dormitory buildings, based on the analysis of evacuation behaviour in high-rise apartment building fire at Ambleside, Ottawa and Forest Laneway, North York. She proposes that stay-in-place is only appropriate if the building is constructed of non-combustible material, equipped with self-closers on all main doors, has a central alarm system to warn occupants and voice communication system to inform occupants of the evolution of the incident and the protect-in-place activities which should be applied.

Sekizawa et al. (1998) studied the occupants' behaviour in response to a high-rise apartment fire occurring in October 1996 in Hiroshima City, where a 20 storey apartment building built in 1972 caught fire. The fire first started on the 9th floor and quickly spread up to the 20th floor through the balconies. The authors concluded that (1) many respondents who start their evacuation are not motivated by

fire cues but others. (2) In terms of exit choices, the possibility of occupants to use elevator for the evacuation is dependent on which level they stay and not an age of the occupants. (3) Occupants are likely to choose the route that they are familiar with or they think is safe instead of the route closer to them. (4) It is very common in high-rise apartment buildings to be provided with horizontal routes for evacuation on a floor.

It is hard to say whether occupants would use this route, and therefore education or directives to the occupants are necessary to make them understand and appreciate the advantages of the existence of horizontal routes for evacuation in building fires. Proulx (1998) studied the impact of voice communication messages during a residential high-rise fire in a 25-storey apartment building located in Ottawa, Ontario Canada. This building was mainly occupied by senior citizens, the majority of whom were over the age of 65. The researcher used two methodologies to gather the data: i.e. face-to-face interviews with the occupants of the floor where the fire started and the floor above; and a questionnaire survey to the rest of the occupants in that building. The intention of the study was to gather information on the behaviour of occupants who were in the building at the time of the fire incident. The study concluded that most occupants treat the sounding of a fire alarm as a warning and wait for further information over the voice communication system, or other sources, before starting to evacuate. It is considered a very risky approach, where occupants delay starting their evacuation, unless the exit routes are very well protected from smoke entry and no one opens doors on the fire floor that could allow smoke into other locations such as the stairwell.

2.9 FIRE RISK MANAGEMENT

The term 'Risk' was first used in the year 1621. In the same year, the Oxford English Dictionary provided a definition of risk as the susceptibility to the likelihood of destruction, loss, damage and other unexpected natural calamities; therefore, risk centres on conditions that favour such likelihoods (Federal Emergency Management Agency, 1997, p. 15). Some sociologists hold the view that risk came into existence as a result of the shift from the traditional society to modern society. Risk occurs in various spheres of life, i.e. there is social risk, political risk, economic risk, technological risk, and so on (Karter and Donner, 1978, p. 55).

The term 'Risk' in the context of this study can be taken to mean the outcome of uncertainty on intentions. Uncertainties refer to events which have a possibility of occurring or not occurring, and these uncertainties exist as a result of limited information available or vagueness of the available information (Stone, 1993, p. 34; Smith, 1994, P. 3). Risk, therefore, is an assessment of probability and the results of an extreme effect on humans, assets, corporations, environment and society as an outcome of a related event, action or process (Federal Emergency Management Agency, 1997, p. 15). With regard to this study the event that is associated with the risk refers to the occurrence of fire together with its consequences relating to smoke effects, heat effects, and other harmful effects that stem from the incident.

There are varied definitions of the term 'Risk'; each definition is unique in its own way and also entails that different systems to control and manage the risk are put into place. For instance, in the field of computer science, the term 'Risk' can be taken to mean the possibility that unwanted programs might find their way into computer systems and thereby lead to corruption of files and documents; the remedy

for this kind of risk is to put into play efficient information security apparatus. In the same way, in the field of finance, financial risk entails the fact that the invested instrument might not yield the expected returns; this provides another dimension and aspect of risk as it requires another different remedy (Federal Emergency Management Agency, 1997, p. 8).

The probability level of fire risk is usually calculated with regard to the number of fire incidents experienced in the past. In order to estimate the probability level, it is important to have information or data relating to past fire occurrences. This information or data may entail data involving past fire loss, information on experiences from related municipalities and also information generated from members of the society relating to their past experiences with fire incidences (Munson, 1983, p. 193). In addition to this, it is important to make proficient judgments with regard to the past fire experiences so as to calculate the likelihood levels.

There are five probability levels that are associated with fire risks. They include: (a) level one – rare: this implies that the risk may only take place in special situations. Based on the past fire experiences; it is expected that when the probability level of the risk is rare, then no fire incident has taken place in the last 15 years. (b) Level two – unlikely: this implies that the risk can take place only if the current conditions change in its favour; it is expected that when the probability level of the risk is unlikely, then fire incidences have been reported in the last 5 to 15 years. (c) Level three – possible: this implies that the risk can take place with the current existing conditions; it is expected that when the probability level of the risk is possible, then one incident has been reported in the past 5 years. (d) Level four –

likely: this implies that the risk is expected to occur at any time in line with the existing conditions; it is expected that when the probability level of the risk is likely, then many fire incidents have been reported in the past 5 years. (e) Level five – almost certain: this implies that the risk is certain to occur unless the current existing conditions change; it is expected that when the probability level of the risk is almost certain, then very many incidences have occurred in the past year.

When estimating the level of risk probability, it is essential to use the rate of the incidents occurring as a guide. This rate varies from one community to another; hence, the study focuses on Saudi Arabia as the case study.

The consequence level refers to the possible damage, losses or harmful repercussions that are connected with the occurrence of the event (Sternlieb and Burchell, 1973, P. 30). Consequence levels are computed after making proficient judgments and analyzing past incidences. When measuring the confidence level with regard to fire risks, four components are taken into consideration: (a) safety of life: this implies the bodily harm or deaths to the house occupants or firefighters as a result of being exposed to the harmful effects of fire such as heat and smoke; (b) loss of assets: this implies the destruction of buildings, valuable property or assets and important infrastructures by fire hazards; (c) economic effect: this implies the loss of money as a result of destruction of buildings, destruction of businesses, loss of jobs and decline in the tourism industry caused by the fire outbreak; and (d) environmental effect: this implies the damage to the physical environment that is caused by the fire outbreak. Fire destroys the habitat for many species of animals or plants. It also leads to the contamination of soil, thus, making the land unproductive (Federal Emergency Management Agency, 1997, p. 15).

The fire consequence levels can be grouped into five categories with regard to their harshness: (a) level one – insignificant: this implies that the consequence of fire does not result to any loss of human life or property; only a limited value of property is destroyed. In addition, the fire hazard does not change the conditions of living or the economic condition (Karter and Donner, 1978, p. 55); (b) level two – minor: this implies that the fire risk poses a possible threat to human life, a small value of property is destroyed and there is a negligible effect on the business environment and also on the conditions of living; (c) level three – moderate: this implies that the fire incident has an average threat to human life and property; in addition, the fire poses an average threat to the business environment and to the conditions of living (McEntire, 2004, p. 25); (d) level four – major: this implies that the fire incident poses a huge threat to human life and can result in a great loss of life and property. In addition, the fire incident causes great damage to the business environment and tourism. The damage caused by fire to the environment is enough to call for evacuation of the residents and the local businesses (Federal Emergency Management Agency, 1997, p. 15); (e) level four – catastrophic: this implies that the fire incident results in fatal deaths and collateral damage of property. In addition, the fire incident results in a lasting interruption of the business environment and tourism. Also, the fire incident can result in a lasting evacuation of residents and businesses (Munson, 1983, p. 193).

When the probability levels and the consequence levels of the fire risk are allocated to the extreme effects of the risks associated to fire, then an overall level of risk is achieved (Stone, 1993, p. 34; Smith, 1994, P. 3); this can be analyzed through the utilization of the Risk Analysis Matrix tool. The matrix is designed in such a way that the bottom right corner contains the highest overall level of risk, while the top left

corner of the matrix contains the lowest overall level of risk. One benefit of the Risk Analysis Matrix tool is that it makes it possible for categorization and ordering to take place for the circumstances that necessitate the occurrence of the risks.

Table 2.6 Risk Analysis Matrix

RISK ANALYSIS MATRIX-Level of Risk (Priority level)					
Probability	Consequence				
	1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)
1 (Rare)	L (L1)	L (L1)	M (L2)	H (L3)	H (L3)
2 (Unlikely)	L (L1)	L (L1)	M (L2)	H (L3)	E (L4)
3 (Possible)	L (L1)	M (L2)	H (L3)	E (L4)	E (L4)
4 (Likely)	M (L2)	H (L3)	H (L3)	E (L4)	E (L4)
5 (Almost Certain)	H (L3)	H (L3)	E (L4)	E (L4)	E (L4)

Source: Federal Emergency Management Agency, 1997, p. 8

The risk and priority levels are defined as follows:

- L = Low Risk

Priority Level 1 (L1)-manage by routine programs and procedures, maintain risk monitoring

- M = Moderate Risk

Priority Level 2 (L2)-requires specific allocation of management responsibility including monitoring and response procedures

- H = High Risk

Priority Level 3 (L3)-community threat, senior management attention needed

- E = Extreme Risk

Priority Level 4 (L4)-serious threat, detailed research and management planning required at senior levels

2.9.1 Community Fire Risk Factors

The defining attributes of a fire risk always influence the kinds of fire risks that the community is susceptible to. For instance, the kind of fire risk that a household is vulnerable to is greatly different from the kind of fire risk that an industrial centre is susceptible to (Karter and Donner, 1978, p. 55). In the same way, a neighbourhood with old fashioned buildings will have a different level of fire threats as compared to a neighbourhood with new modern buildings. In addition, a society that encompasses older and senior people will have a different kind of challenge as compared to a society that consists of younger and youthful individuals (Stone, 1993, p. 34; Smith, 1994, P. 3). There are very limited resources concerning fire safety management in dwellings in the developing countries. However there are a number of publications regarding the fire risk and safety management processes in the workplace. Furness

and Muckett, (2007) give definitions of the terminology which is normally used in the fire safety discipline, including for example:

- Safety, i.e. the freedom from unacceptable risk from harm;
- Hazard, i.e. a source or situation with the potential to cause harm (death, injury, ill health, damage to property or environment). A source or situation that could cause harm such as chemicals, electricity, working at height, hot work processes and in case of emergency an inability to respond and escape to a place of safety;
- Harm, i.e. includes the effects relation to human injury and ill health, damage to the environment or loss to an organisation;
- Risk, i.e. the combination of the likelihood and severity (consequence) of a specified event occurring and should it to do so, the severity of the outcome;
- Risk assessment, i.e. the process of identifying hazards and evaluating the level of risk (including to whom and how many are affected) arising from the hazards, taking into account and existing risk control measures; and
- Risk controls, i.e. workplace precautions, for example a guard on a dangerous part of machinery, sprinkler systems within a building, safe systems of work (procedure), personal protected equipment (PPE), safety signs.

The Fire Protection Association (FPA), (2003) gives a basic fire safety design framework. A fire safe building should be consider as one that provides adequate means of escape, adequate facilities for fighting fire i.e. including adequate water supplies and access for firefighting and brigade vehicles, and adequate property and business protection. The FPA (2003) also proposed a guidance framework for

designing buildings for life safety and property protection. Designing a building for life safety should follow the statutory requirements and fire safety engineering approach and for property protection should following fire safety engineering and Loss Prevention Council (LPC) design guide for fire protection of buildings. It should be noted that both the life safety and property-and-business starting point allow for a fire safety engineering (FSE) approach as an alternative approach (perhaps to deal with a specific issue) to the appropriate guidance document. It is the responsibility of the designer or his/her fire safety consultant to justify that the FSE approach provides as adequate level of safety in respect to the protection of business. There are twelve designs principle proposed by FPA (2003) to achieve fire safety objective, i.e. life safety and property protection etc.

A number of methods have been proposed to evaluate risk management for fires. The method applied for any particular risk will depend on a number of factors, such as the complexity of the activities carried out and type and nature of the workplace. Methodologically there are three common methods usually used: qualitative analysis – describes the quality of risk using words; quantitative analysis – quantifies the risk with numerical data; and semi – quantitative analysis – uses numbers to quantify qualitative data (Furness and Muckett, 2007). Qualitative analysis describes a quality of the risk. Typical of the qualities most often described is that of quantum, i.e. size or magnitude. For example, when assessing the means of escape in the event of a fire, fire risk has historically been rated as high, normal or low. Quantitative analysis evaluates factors not by subjective judgement, but by numerical data. Quantitative evaluation of risk is more demanding than qualitative approach but provides a more rigorous evaluation.

Semi-quantitative analysis techniques for risk assessment are widespread and it is often referred to as a quantitative method, however, it is easily seen that although risk is expressed as a numerical value, the estimation of the magnitude of the risk is in fact subjective and therefore qualitative. Semi-quantitative evaluation of risk allows numerical values to be assigned to both severity and likelihood in the absence of data (Furness and Muckett, 2007). At present there is no quantitative method of assessing the adequacy of any escape route provided in a building other than by empirical means. The current method of providing means of escape from buildings is by specification and rules, i.e. rules that have evolved through time and are deemed to provide a satisfactory escape route (Shields & Silcock, 1989). Coelho (2004), introduced a conceptual model for fire safety risk analysis in building proposed by The Laboratorio Nacional de Engenharia, Portugal, as in Figure 3.3, which consists of 12 sub-models interlinked each other centred into data information management model for fire risk analysis.

The National Fire Protection Association (NFPA, 2000) has developed a basic approach to minimise fire risk called The Fire Safety Concepts Tree (FSCT). FSCT was derived to achieve the fire safety objectives, first for life safety and second or structure protection. There are two fundamental principles of the FSCT, Prevention of Fire Ignition, and Managing Fire Impact. Prevention of fire ignition can be done in the early stages of the building design process by eliminating fire sources but to completely eliminate fire sources is impossible. No matter how much effort is put in to prevent ignition, fires continue to start. Once a fire has started, we have to manage the fire to minimize the impact on the people and structures. FSCT emphasises fire suppression, control of combustion and containment of fire by construction. To manage the impact, FSCT emphasises safeguarding the exposure

and limiting the amount exposed. Among measures that can be applied to achieve the fire objectives are prevention of fire ignition, providing the means of detection, equipping with fire extinguishing equipment, controlling fire from spreading to the other parts of building and allowing time for people to evacuate from the building.

The purpose of risk assessment is to assist an employer and/or a 'responsible person' to identify the preventive and proactive measures required to comply with the law and in doing so, ensure, as far as reasonably practical, the safety of their workforce, premises and those around them who could be affected by their activities (Furness and Muckett, 2007).

Risk management explained in NFPA 1500 consists of four components (Angle, 2005):

- i. Risk Identification;
- ii. Risk Evaluation;
- iii. Risk Control; and
- iv. Risk Management Monitoring

According to Douglas (2002), besides the four components of risk management proposed by NFPA, there is one more component, i.e. Audit, Review and Feedback. Information from the Fire Risk Solutions web site, (FRS, 3/2008), suggests general requirements of fire risk assessment are:

- i. Firefighting equipment measures,
- ii. Signage,

- iii. Adequate training of personnel,
- iv. Escape routes and exits,
- v. Maintenance, and
- vi. Records

According to the FPA (3/2008), fire risk assessment involves identifying the potential sources of ignition in the workplace, the combustible materials that are present as part of the business operations, the furnishings and the structure in which the business is carried out. The people who use the premises must also be considered. These include staff, customers, visitors, or members of public. The means of escape, equipment for detection and giving warning in case of fire and fire-fighting apparatus are appropriate for the premises and numbers of people present also must be considered. Primary fire risk assessment is to ensure a satisfactory escape route, suitable arrangements are made to detect and give warning of a fire, and that appropriate fire-fighting equipment is strategically located around the workplace. FPA provides online self-assessment by answering 51 questions to fulfil minimum requirements for fire risk assessment.

The British Standard Institution (BSi, 2003) in document PD-7974-7:2003: Application of fire safety engineering principles to the design of buildings, gives a general approach for probabilistic of fire risk assessment process. After hazards have been identified, frequency analysis or consequence analysis should be carried out before evaluation of risk can be done. There are two outcomes, i.e. either risk is acceptable or unacceptable. If the risk is acceptable, it means that fire safety is adequately installed, the building is safe to be occupied. If the risk is unacceptable, it

means fire safety is inadequately installed and the building is very risky to live in. Therefore the risks identified should be reduced. Appropriate measures should be taken to ensure all instruction, recommendations and suggestions from the fire safety personnel who carried out a fire risk assessment are seriously considered to ensure all identified risks are eliminated or reduced to an acceptable level. According to the guideline produced by HMSO (HMG, 2006) on how to do a fire risk assessment, there are five steps for fire risk assessment.

Different premises have different guidelines but the steps in fire risk assessment are all the same. From those guidelines, unfortunately, all of them are intended to be used for non-domestic premises. There is no guideline for domestic houses or for high-rise residential buildings because there is no compulsion for domestic buildings to have a fire risk assessment. There is a web site, i.e. www.firesmart4home.co.uk, which offers a free online assessment for domestic fire risk assessment for those interested to do so. Meanwhile, FPA (2008) offers free online fire risk assessment for a workplace. Safeandhealthyworking.com gives an example of a fire risk assessment form. So far, the guideline produced by HMSO which is closest to the residential building occupancy is fire safety risk assessment for residential care premises as follows:

Step 1: Identify fire hazards

Step 2: Identify people at risk

Step 3: Evaluate, remove, reduce and protect from risk

Step 4: Record, plan, inform, instruct and train

Step 5: Review.

Step1: Identify fire hazard

Identify source of ignition, e.g. smoking material i.e. cigarettes, matches and lighters; naked flame i.e. candles or gas or liquid-fuelled open flame equipment; electrical, gas or oil-fired heaters; cooking equipment; faulty or misused electrical equipment; lighting equipment; hot surface; hot processes e.g. welding by contractors; arson, deliberate ignition, vandalism and so on.

Identify source of fuel i.e. anything that burns is fuel for a fire e.g. toiletries, aerosols, plastics and rubber, wood and wood based furniture, flammable products e.g. petrol, white spirit, methylated spirit, cooking oils and so on. Identify source of oxygen, i.e. the main source of oxygen for a fire is in the air around us. In an enclosed building this is provided by the ventilation system in use. Additional sources of oxygen can sometime be found in materials used or stored at premises e.g. some chemicals i.e. oxidising materials which can provide a fire with additional oxygen and so help it burn; oxygen supplies from cylinder storage and so on.

Step 2: Identify People at Risk

Identify people at risk means that all people who may be present in the premises, should be identified, either as permanent residents or occasional visitors who may be present either regularly or at specific times, persons who may need special assistance, e.g. disabled or elderly individuals and children. Identification should be made of who they are, why they are at risk and where to find them in the event of fire

Step3: Evaluate, remove, reduce and protect from risk

Evaluate means examining critically the possibility of the risk of fire occurring and the risk to people, and trying to identify accidents waiting to happen and any acts or omissions which might allow a fire to start. Evaluation is necessary of the actual risk to those people listed in step two should a fire start and spread from various locations that have been identified earlier.

Evaluate the risk of fire occurring: In general, fires start in one of three ways: accidentally, e.g. when smoking materials are not properly extinguished or when bedside lights are knocked over; by act of omission, e.g. where electrical equipment is not properly maintained or waste is allowed to accumulate near to a heat source; or deliberately, e.g. arson attack involving setting fire to external rubbish bins placed too near to the building.

Evaluate the risk to people: there is a need to understand the way fire can spread. Since smoke is a major threat to people, it is essential to evaluate the possibility of smoke spread within the building. It is essential that the means of escape and other fire precautions are adequate to ensure that everyone can make their escape to a place which is totally safe before the fire and its effects can trap them in the building. Remove or reduce the hazards that may cause a fire: Upon identifying the possible hazard that may cause fire, recommendations should be made to remove or reduce it instantly.

There are various ways that hazards can be reduced: for example:

- Replace the possible high hazard with a safer alternative.
- Operate a safe smoking policy, ensure sufficient ashtrays are provided and always keep them clean appropriately.

- Ensure all electrical, mechanical and gas equipment is installed, used, maintained and protected in accordance with the manufacturer's instructions.
- Ensure that all electrical fuses and circuit breakers are of the correct rating and suitable for the purpose and that electrical sockets are not overloaded.
- Remove or reduce sources of fuel: All sources of fuel are needed to be reduced or stored in a very secure place. There are many ways this can be done, for example:
 - Reduce the amount of combustible materials.
 - Ensure all combustible materials especially highly combustible materials are separated from potential ignition sources.
 - Do not keep flammable solids, liquids, and gasses together.
 - Take appropriate action to ensure all premises particularly storage areas being vulnerable to arson or vandalism, and so on are secured.

Other aspects that need be closely looked at are:

To remove or reduce the risk to people i.e. by providing flexibility of fire protection measures, providing fire detection and warning systems, ensure escape routes are safe and ready to be used at all material times, all occupants are aware of the evacuation strategies, the number of escape routes and exits, management of escape routes, emergency evacuation of people with mobility impairment, emergency escape lighting, escape signs and notices, maintaining safety equipment, and so on.

Step 4: Record, plan, inform, instruct and train

Record the significant findings and action taken for further reference. Significant findings may include details of; fire hazards that have been identified, actions that have been taken or will be taken to remove or reduce the chance of fire occurring, persons who may be at risk, and particularly for those who have special needs, actions that have been taken, or will be, taken to reduce the risk to people from the spread of fire and smoke, and so on.

Plan: it is necessary to have an emergency plan and record all details. If necessary, ensure that the emergency plan takes into account other emergency plans which may be applicable to the same building. The plan should be readily available to all occupants, and the emergency plan available to the enforcing authority.

Inform: There should be clear information, instructions, and what to do in the event of fire or if somebody discovers a fire in the building. These should be available to all people in the building, occasional visitors or persons who are working in the building. The information and instructions that should be given are based on the emergency plan and must include: the significant findings from a fire risk assessment, the measures that have been put in place to reduce the risk, who is responsible for what if there is a fire, identification of people who will be responsible for the fire safety, the importance of closed doors, and any special arrangements for serious and imminent danger to persons from fire.

Training: The type of training should be based on the particular features of the premises or building and it should take into account the emergency procedures, work activities taking place during normal occupancy, and be tested by fire drill.

Step 5: Review

Fire risk assessment should constantly monitor and review. If there is any reason to suspect that there are significant changes in certain circumstances and the previous fire risk assessment is no longer valid, it should be reviewed or if necessary revised. Reasons for review could include: change in work activities, alteration to the building, substantial changes to furniture and fixings, increases in storage of hazardous substances, significant problems reported by residents or staff, significant increase in the number of people, and so on. Example of fire risk assessment checklist is as in Appendix 2.4 which can be downloaded at www.communities.gov.uk/fire. BRE, (3/2008), using the same format as in the guideline proposed by HMSO i.e. five steps fire risk assessment process. Fire Risk Assessment Online (FRAO, 2008) states that a fire risk assessment should identify fuel sources, ignition sources, means of escape, firefighting equipment, arson prevention, fire warning systems, emergency signage and lighting, and so on.

Therefore it is evident that despite the myriad of practitioner orientated measures and frameworks, there is surprisingly very little on assessing the management issues required by policy makers and senior management or fire leadership on how to ensure these frameworks are effectively executed. Even less exists from the perspective of developing countries, let alone from the Kingdom of Saudi Arabia. Therefore this study is clearly needed since generally in the literature no study could be found to assess the management issues most important for policy makers in ensuring the design, development, implementation and therefore evaluation of a national level fire hazard policy or framework.

Indeed, much of the research on fire hazards has concentrated on identifying individual level causes of fires. This body has a rich history and is revised here to further demonstrate the need to generate a shift in the direction of research towards management of these causal factors from a policy making perspective.

2.10 HUMAN BEHAVIOUR PERSPECTIVE ON FIRE HAZARD MANAGEMENT.

Behavioural analysis is generally used in psychology but lately its application has been extended, including areas of social concern. This is a scientific approach to human psychology derived initially from the work of Skinner. There are four main parameters which mainly influence the behavioural analysis (Leslie, 2001):

- Behaviour must be understood and analysed at the level of the individual person;
- Behaviour of the individual is situation-specific;
- Behaviour in a situation is a function of previous experience in that and similar situations; and
- Situation and historical factors largely account for observed behaviour i.e. historical of interaction the individual has in relevant situations.

Leslie mentioned that how we behave in a particular situation is largely determined by what we have done on previous occasions in that and similar situations. There are two types of experiences; 'hands-on experience' and 'knowledgeable experience'. Hands-on experience is an experience where persons have been involved personally in an occasion, and knowledgeable experience is

where persons get information and understand how an occurrence happens mainly based on literature and discussion. The main focus of behavioural analysis is intervention in behavioural assessment by asking questions, i.e. when and where did the behaviour occur? What action do the people concerned take? And why do they do it?

Functional analysis – this approach generally assesses the motivation behind behaviour and action in an emergency event. This has to be dealt with on an individual basis and practical for a small research sample. However, in a real situation when fire breaks out, human behaviour is unpredictable and can be very strange. Chandrakantan (2004) has cited that Sime (1990) has discussed the panic behaviour of some people in emergencies, and Wood (1990) has analysed the way people react to fires. For example, in findings reported by Wood, some people went only short distances through the smoke, but many of them advanced farther than they could see. Knowing the fact that people navigate through smoke, it is a responsibility to provide evacuation systems that are visible in smoke, wherever feasible. Exit signs are essential components of evacuation systems (Ouellette, 1993). Clintock et al. (2001) studied a behavioural solution to the “learned irrelevance” of emergency exit signage and concluded that people recognise the current emergency exit signage and associate it with safety in an emergency. However, people for the most part do not notice emergency exit signage when they are involved in everyday activities, e.g. shopping. Part of the reason people have underused emergency exit signage is because they have acquired learned irrelevance to it. However there are a number of factors affecting the perception of risk and their impact on human behaviour in fire and this varies between individuals and groups for various psychological, social, and cultural reasons. For some

individuals, fire may be dreaded, while for others, it is something that will never occur. There are many reasons for these, which is known as part of the psychometric paradigm of risk, among them are (Meacham, 2001):

- Perceived voluntariness of the exposure,
- Perceived level of protection affordable,
- Familiarity of the risk,
- Catastrophic potential,
- Immediacy of the effects,
- Distribution of risks,
- Judgements about who or what is perceived as causing the hazardous situation,
- Controllability,
- Degree of technical knowledge available, and
- Exposure pattern.

Success in a building evacuation depends on many factors including (Livesey et al, 2001):

- Floor plan of the building, i.e. building-specific constraint, which has multiple sub-attributes e.g. signage, corridor width, staircase width, floor finishing, and alarm system.

- Occupants profile, i.e. people-specific constraint, with multiple sub-attributes e.g. age, mobility impairment, panic behaviour and number of occupants or density.
- Potential visual and sensory capabilities, i.e. finding the way depends on lighting and architectural layout as more significant design criteria than travel distance in modelling evacuation. The authors suggest that more extensive study on the occupants profile, relationship between evacuation times and the structural measures of building complexity, depth and measure of integration are needed.

To enable people to evacuate a building quickly and safely in an emergency it is important that they can navigate around parts of a building that are new to them, no matter what the conditions are. One aspect that should be investigated is how effective various emergency lighting systems or low mounted way guidance systems are when the air contains smoke (Wright et al., 2001). Research in the field of fire engineering into human behaviour in fire is largely directed by the needs of the models of response that are currently accepted. Primary areas of research are those that provide data to first profile the occupants and then to predict; cue recognition by occupants or occupant groups, their subsequent actions, their times for starting to respond, their movement times and their sensitivity to fire product. The outcome of occupants experiencing a fire is the product of their responsiveness to fire cues and some behaviour is generally occupants reacting to fire rather than interacting with fire (Brennan and Thomas, 2001).

2.10.1 Population and Building Factors:

Two most important factors are the building characteristics and the population. Building characteristics include the building structure, equipment for firefighting, number of people within the building, quality, and location. According to

Huang (2009), Building structures composed of poor materials are very prone to fire attacks, just like the poor quality housing as a result of poor building systems, techniques or strategies (Been, 2004.). Absence of equipment for firefighting within the building increases the rate of fire incidence. Location of buildings causes overcrowding and this increases the chances of such buildings to be attacked by fire (Mysoerekar, 2006). The building techniques and methods are also determinants of the rate of fire incidences (Huang, 2009).

Developed countries do not face the challenges of income, poverty and population (that is the numbers of persons within the housing), due to their developed economic structures (Jennings, 1999). The various factors they face that lead to high incidences of fire include those related to the types of building and especially the abandonment of housing caused by high rates of affording such houses (Huang, 2009). To some extent, they also face natural causes as factors or determinants of rate of fire incidences. They are determinants of the rate of fire incidence as well within a residential area (Been, 2004).

The developing countries on the other hand are faced by income and poverty problems (Yvette, 2007). China and India are not developing countries but research performed by Huang (2009) has proved that their poverty rate is high: almost at the same level with the developing countries (Corcoran, Higgs & Higginson, 2011). They face a housing population where many people live in the same house due to insufficient income to build or have different houses.

Fire incidences are correlated to the city characteristics ranging from income, poverty, housing structures, types of houses, population within the houses, to housing abandonment (DiGuseppi et al, 2002). These factors however differ from

one country to another as well as one city to another. There are various categories of factors causing high fire incidences (Jennings, 1999). These categories are political, economic, environmental, social, and natural causes. Social and economic factors combined to give socioeconomic factors are the most common factors experienced amongst cities and countries in residential and industrial areas (Donnell, 2009). Socioeconomic factors refer to human behaviour and this conduct is sometimes very detrimental in regard to fire incidence rates (DiGuseppi et al., 2002).

Socioeconomic factors include population, demographics, building, and to some extent natural causes characteristics such as the tsunami caused by environmental changes as a result of human actions such as burning of coal and forests (Jennings, 1999). Researchers have shown that places inhabited by low income earners are more prone than those places inhabited by high income earners (Slovic, Fischhoff and Lichtenstein, 2005). The various factors they face that lead to high incidences of fire include those related to the types of building and especially the abandonment of housing caused by high rates of affording such houses (Huang, 2009).

In any case, many cases of deaths and destruction by fire have been reported in various non-residential matters, raising concern even further. It is generally agreed that fire can lead to loss of life and significant financial damage and disruption of economic activities and trauma to victims, which may be experienced through the destruction of property of various individuals and organisation. From the many factors capable of creating such fire outbreaks, socio-economic factors have taken the lead, and thus there is a need to develop measures corresponding to such factors. Low socioeconomic status has widely been identified as a risk factor for fire

incidences not only in the developing countries but also in developed countries (Boyce and Shield, 1999).

Some of the socioeconomic factors that have led to increased rates of fire incidences include overcrowded living conditions, lack of proper safety measures as well as inadequate parental supervision of children, among others. This study attracted the researcher to explore the relationship between socioeconomic factors for increasing the incidences of fire in dwelling premises.

The following discussion focuses on the various forms of community fire risk factors as well as socio economic factors that have so far given concern because they have proven to be very difficult. The discussion attempts an analysis of the various forms of human related activities that are effective in achieving the required reduction in the rate of fire incidences.

2.10.2 Community Fire Risk Factors

The defining attributes of a fire risk always influence the kinds of fire risks that the community is susceptible to. For instance, the kind of fire risk that a household is vulnerable to is greatly different from the kind of fire risk that an industrial centre is susceptible to (Karter and Donner, 1978, p. 55). In the same way, a neighbourhood with traditionally designed buildings will have a different level of fire threats as compared to a neighbourhood with new, modern buildings. In addition, a society that encompasses older and senior people will have a different kind of challenge as compared to a society that consists of younger and youthful individuals (Stone, 1993, p. 34; Smith, 1994, P. 3).

It is essential to be familiar with the appropriate information regarding the attributes of a particular community before proceeding to evaluate the level of fire risk that it is prone to. A total of eight known factors contribute to the occurrence of fire risks; these are: stock of the property, height and boundary, age and mechanism of construction, outlook of the building, profile, infrastructure, fire history, load of fuel (Karter & Miller, 1990; Runyan et al., 1992; DiGuseppi et al., 2000) (Levine & Radford, 1977; Brodzka, Thornhill & Howard, 1985; Copeland, 1985; Conley & Fahy, 1994; Elder, Squires & Busuttil, 1996; Baux et al., 1989; Waller, Marshall & Langley, 1998; Istre et al., 2002; Karter & Miller, 1990; Mashall et al., 1998; Runyan et al., 1992; Barillo & Goode, 1996; Notake et al., 2004; Miller, 2005).

Stock of the Property

This factor regard maintenance of a detailed record of the stock of property that is at the disposal of the community; this assists in maintaining a good inventory and planning for the potential fire hazards (Munson, 1983, p. 193). Maintaining the property stock encompasses conducting a physical count of the occupants in the building and also maintaining a record about the total assets or property that are within the premises. Buildings have been grouped into various classifications with regard to their proneness to the risk of fire incidences.

Assembly Occupancy

An assembly building is a kind of building that normally hosts a gathering of people at any given time. These people gather in the buildings for various reasons, including: political reasons, social reasons, recreational reasons, educational reasons, social reasons, and so on. Because these buildings normally host people from different walks of life, they are highly decorated and furnished; these furnishings

and decorations often are combustible. In addition, the lighting system in these buildings is always dim. It is required that special attention should be given to these buildings in order to minimize the chances of fire risks. Only the required number of people should be allowed in these buildings at any given time. Fire or smoke detectors should also be fitted appropriately.

Care or Detention Occupancy

These buildings host people who mainly rely on others to receive special care or attention. Evidence of such buildings includes prisons, hospitals, home-cares, etc. Many residents in these buildings are vulnerable and are exposed to various challenges. Hospitals contain various chemicals that are highly combustible, and in case of fire outbreak a fatal accident might occur. Lack of training to evacuate the public as well as patients from hospitals during disaster period is the major challenge for these buildings. These buildings need to be equipped with the firefighting tools and the workers in these buildings need to receive elaborate training on how to manage disasters (McEntire, 2004, p. 25).

Residential Occupancies

This is the kind of occupancy whereby the residents are granted accommodation facilities and are not held against their will. Studies have revealed that fires resulting from residential occupancies have a chance of 70% of occurring and 90% chance of causing multiple deaths (Sternlieb and Burchell, 1973, P. 30). In addition, residential houses that are situated in multi-storey buildings are more susceptible to fire related risks.

Business and Personal Services Occupancies

This is the type of occupancy that hosts the business environment and process. Most of these buildings are multi-storied; hence, the population of the occupants during business hours is quite large. These buildings are highly furnished and decorated with combustible materials; thus, they are very prone to fire risks. Much effort should be employed toward eradicating fire incidents in all ways possible.

Mercantile Occupancies

These are buildings that serve the purpose of displaying and trading of goods, commodities and other stuff. Numbers of occupancy here are large and such buildings host many people and contain all types of combustible goods. The buildings are designed in such a way that the customers might get confused about the locations of the entry and exit points. In addition, the customers might not be familiar with the fire assembly points.

The high number of occupants in these buildings poses a major challenge, especially when a fire risk occurs. It is recommended that these buildings should be fitted with appropriate signs that indicate the entry points, the exit points and the fire assembly points with the aim of guiding the customers to prepare for any possible events (Federal Emergency Management Agency, 1997, p. 8).

High/Medium/Low Hazard Industrial Occupancies

Industrial occupancies are the mechanisms to organise and set the materials in an industrial premise. It includes; gathering, constructing, stocking etc. Industrial occupancies have three levels of hazards, i.e. low hazards (F3), medium hazards (F2) and high hazards (F1). These levels are with regard to their susceptibility to fire risk (Karter and Donner, 1978, p. 55).

In the industrial occupancies, there might be burning materials and machinery. This machinery presents different levels of threats to the building; hence, safety measures should be enhanced appropriately. When industrial fires occur, large losses to property, business or life are involved; hence, it is beneficial to prevent this kind of damage.

Other Properties

Building premises that contain materials that are highly combustible should be given special consideration. These kinds of buildings include warehouses or other storage facilities. These storage facilities store a wide range of combustible substances like gases, recycling materials and other highly inflammable materials. In addition, much consideration should be given to the modes of transportation that deal with transportation of inflammable commodities so as to avert major disasters (Munson, 1983, p. 193).

2.10.3 Building Height and Area

Building Height

It has been observed that bigger buildings pose a different level of fire risk susceptibility from smaller buildings, even supposing they are located in the same area. Bigger buildings cannot handle the occurrence of risks like smaller buildings. One of the reasons attributed to this is because bigger buildings have a larger population of people, since the buildings have many floors. In addition, due to the high population it takes a longer time to evacuate all the residents in cases where a fire tragedy occurs; there is much overcrowding of people during evacuation. Another reason is that due to the large size of the buildings, it is very hard to

communicate effectively and quickly with everybody during times of hazards. Due to the fact that these buildings are tall, they require large energy sources to power their operations; as a result of this, the building is much exposed to hazards relating to fire risks. The tallness of the buildings also hinders the firefighters in fighting the fires as they take a longer time to climb up and down the stairs; this is also due to the fact that they may share the stairwell with the crowd that gathers around during times of such calamities.

Building Area

Building area refers to the set up in which the building is constructed. Buildings which are constructed in densely populated industrialized areas pose a greater challenge than buildings in quiet places. In addition, firefighters find it very hard to attend buildings that are located in industrial centres due to the fact that they are horizontally extended, thus, making it harder for the unloading process (Stone, 1993, p. 34; Smith, 1994, P. 3).

It is important that these buildings should be constructed with strict safety measures, i.e. warehouses should be open with a wide space so as to facilitate easier access to the fire fighters in case of any hazard. Warehouses may at times contain highly combustible goods, which makes them prone to fire hazards (Sternlieb and Burchell, 1973, P. 30).

Building Age and Construction

In order to avert future incidences of fire occurrence, it is beneficial for the building caretakers to maintain a proper inventory of the buildings. Maintaining a proper inventory will help to pinpoint the basic threats that the building is exposed to and

also assist in preparing for any possible event. However, it is worthy of note that old fashioned and aged buildings have a different level of challenge as compared to new, modern buildings (Federal Emergency Management Agency, 1997, p. 8).

Building/Fire Code Application

Municipalities have passed regulations regarding the construction of new buildings and the maintenance of old buildings. When constructing new buildings, various stakeholders are engaged so as to ensure that the buildings are constructed in compliance with the required standards and specifications.

In order to maximise the protection for the building occupants, many buildings are constructed with anticipation of various risks; hence, when these risks take place, the buildings are efficiently prepared to handle them. The various security issues that are looked at when constructing buildings include: the expected occupants, the height and area of the building, the materials to be used for construction (combustible materials should be minimally used), the installation of fire machinery like alarms and extinguishers, the provision of space for fire extinguishers to access, planning for emergencies, and planning for efficient management and inspection of the building (Munson, 1983, p. 193).

Residential Buildings

This is the kind of building where residents are granted with accommodation facilities. These residents are voluntary. Studies have revealed that fires resulting from residential occupancies have a chance of 70% of occurring and 90% chance of causing many deaths (Karter and Donner, 1978, p. 55). In addition, residential

accommodation situated in multi-storey buildings are more susceptible to fire related risks.

Multi-unit Low-rise and High-rise Buildings

Higher buildings are not able to handle the occurrence of risks like the shorter buildings. One of the reasons attributed to this is because bigger buildings have a larger population of people since the building has many floors. In addition, due to the high population it takes quite a longer time to evacuate all the residents in case a fire tragedy occurs; there is much overcrowding of people during evacuation. Another reason is that: due to the large size of the buildings, it is very hard to communicate effectively and quickly with everybody during times of hazards. Due to the fact that these buildings are tall, they require much energy source to power their operations; as a result of this, the building is much exposed to hazards relating to fire risks. The tallness of the buildings also hinders the firefighters in fighting the fires as they take a longer time to climb up and down the stairs; this is also due to the fact that they may share the stairwell with the crowd that gathers around during times of such calamities.

Building Exposures

Buildings are more exposed to fire risk when they are located in areas with high building densities; this is because of the fact that these buildings are very close to each other. In addition, lack of enough space between the buildings prevents the firefighters from manoeuvring easily. When a fire starts from a building and spreads to the neighbouring buildings, it is referred to as an exposure fire (Sternlieb and Burchell, 1973, P. 30).

When these buildings have already been constructed, it is very hard to increase the spaces between them; thus, it is highly advisable that these buildings should be fitted with the correct apparatus for fighting fire in case of any hazard. In addition, the caretakers or the stakeholders of the buildings should be well aware of the major threats that pose a challenge to the buildings (Sternlieb and Burchell, 1973, P. 30).

There are various factors that cause neighbouring buildings to be exposed to fire hazards. Heat and longevity of the fire, part of the building's outlook, size of the part of the building exposed, alignment of the walls with each other, availability of fire-fighters, and the inability to detect early fires are the aforesaid five factors (McEntire, 2004, p. 25). There are various ways that have been devised to mitigate fire risks. These ways include: installing sprinklers in the buildings, erecting firewalls to separate the buildings, and fitting the buildings with fire-fighting machineries to prepare for any possible event.

2.10.4 Demographics Profile

Each fire challenge is in line with the demographic profile that is at hand. The means for preventing fire risks depends on the various shifts in the community's population; thus, it is relevant to maintain a demographic report of the community in order to be familiar with the profiles of the people who are being looked after (Munson, 1983, p. 193). Demographic profiles should include factors like age of the population, shifts in the population, population size as vulnerable to the fire risk etc.

Distribution of the population by age

When the profile of the population is created with regard to the distribution by age, it becomes easier to point out the members of the society who are susceptible to fire

risk and set up strategies to provide them with adequate assistance (Karter and Donner, 1978, p. 55). When the death rates of the various age sets associated with fire risks are calculated and analysed, then the fire death rate of the population distribution in terms of age is determined. That is to say:

Fire Death Rate= (No.of fire deaths associated with age segment x 1,000,000)/(Population associated with age segment), (Source: Munson, 1983, p. 193).

A study conducted in Saudi Arabia with regard to the fire death rate of the various age sets of the population revealed that the fire death rate starts to increase at the age set of 50 to 64 years old. Based on this study, the overall population's level of fire death rate was set at 8.4 deaths per every million people. Beyond the age of 85 years old, the portion of the population is totally exposed and is much susceptible to fire risk; hence, a very high level of death rates.

It is very evident that older people pose a major challenge to fire risk in Saudi Arabia. This could be attributed to the fact that as a person grows older, his/her physical abilities deteriorate so much. This can cause them to lose some important senses such as eyesight, hearing, and acquire other forms of illnesses. Because of their weak physiologies, the aging people are so vulnerable to the harmful effects of heat and smoke when a fire tragedy occurs.

It is postulated that the fire death rate of the older age set of the population will continue to increase if measures to tone down the fire risks are not undertaken for this particular group of the population. It is, therefore, very beneficial to protect the older people as they hold a high position in the society.

The study also found that younger children who are below the age of 5 years are more susceptible to fire risks. This is attributed to the fact that children at this age are not yet mature enough and entirely depend on the adults for care and provision of safety. In addition, their physical abilities are still not yet developed; hence, they can hardly stand the harmful effects of heat and smoke. Moreover, children at this age are adventurous and they can be tempted to play with fire or combustible items out of their curiosity; this could result in fatal damage.

Population Shifts

The population of the community always shifts in different forms throughout the year; these shifts have various effects that call for measures to mitigate the fire risks. During the summer, tourists come to visit; this results in an increase in population. When the population increases, the vulnerability to fire risk is also increased. Apart from tourism, certain parts of the community might play host to large events that take place for a fixed period of time; this also results in a sharp increase of the population during such times, thus, raising the level of fire risks. Schools and colleges also host quite a number of people during school days; this also raises the level of fire risks in these places.

Another form of population shift is demonstrated in the case where a large portion of the population leaves for town to work and gets back to their homes in the evening. During this time, the population of the community is majorly reduced during the day and increases at night; this change in population at night presents a certain level of risk to the community.

Vulnerable Individuals

In order to avert a major fire tragedy, it is very important to identify the vulnerable members of the community. Such vulnerability is seen in terms of the age of the individuals (very young and very old), individuals who abuse drugs and alcohol, and other individuals with special needs. It is imperative that special attention should be given to hospitals, rehabilitation centres, children day-care centres and long-term care homes so as to be in a position to tackle any fire threat that might possibly occur.

Hindrances to Public Education

One of the biggest challenges facing public education is that of language barriers; this is due to the fact that Saudi Arabia is a country with diverse ethnicity. As a result of this, it has become increasingly difficult to teach the public on how to prevent and manage fire hazards in order to avert major losses to lives or property or businesses.

Levels of Income

There are high levels of fire incidences in low income dwellings. This may be due to the fact that the population in these areas is careless when it comes to preventing fire risks. Many empty buildings in these areas play host to the homeless or street children who drink and smoke carelessly. In addition, the owners of the buildings in these sites take too long to repair the building; thus, making them vulnerable to fire hazards. As a result of lower incomes, many occupants do not have the ability to purchase firefighting equipment. The low income residents have the highest number of single parents who cannot effectively manage their children, thus exposing them to fire risks. Nevertheless, the low level of education in these places makes it hard for the residents to read the manuals that come with electrical appliances; hence, they cannot follow the instructions adequately.

Geography/Topography/Road Infrastructure

The ability of the firefighters to reach areas with fire outbreaks can be majorly affected by the geography, topography and the road quality that is in the area. In addition, it is very hard for the firefighters to manoeuvre in areas with harsh weather conditions. Once these obstacles have been noted, it is advisable that an evaluation of what needs to be done is carried out. The ultimate objective is to ensure that the fire department has an easy and a smooth access to the affected areas in good time to stop further damage to life or property (Sternlieb and Burchell, 1973, P. 30).

Roads and Access Routes

The conditions of the various roads or routes that exist within the community should be improved in order to grant easy access to the fire department. Maintenance should be carried out to the roads throughout the year to maintain their quality; in addition, the roads should be wide enough to accommodate the fire department trucks. In cases where there are railway crossings, alternative routes should be used in order to avoid delays. Also these roads should be maintained in such a way that they are not affected by extreme weather conditions (Karter and Donner, 1978, p. 55).

Traffic Patterns

Traffic patterns majorly concern urban areas, due to the degree to which these areas are prone to traffic jams. Traffic congestion can cause unexpected delays to firefighters when they are on course to a major fire. The patterns of the traffic should be reviewed so as to come up with a plan of alternative routes to use in case of fire.

Natural Terrain

The geography or topography of a community can affect the speed of response at times of fire. Greater consideration should be given to hilly areas, areas prone to floods, islands, forests and wetlands so that proper response planning is undertaken.

Past Fire Loss Statistics

When a historical analysis of fire incidents that have taken place in the recent past is conducted, it becomes possible to point out the possible risks and fire trends or patterns that are likely to affect the community. The data in the analysis should contain the figure of fire incidents, the figure of casualties, and the amount of property destroyed. When analysing the past fire loss statistics, it is important to look at the type of occupancy, the age of casualties, the fire cause, the point of origin of the fire, the frequency of the fire occurrence, the time of fire occurrence, and the level of responses to the fire.

The analysis of the past fire losses is very beneficial in yielding information that is relevant in making comparisons and planning for responses. It is very beneficial for the community to conduct this kind of analysis in order to be in a good position to avert any major fire risk. Once this is done, relevant strategies can be put into play so as to prevent more fire hazards.

Fuel Load

Fuel load refers to the amount of combustible components that are contained in the building. These combustible materials affect the rate and the length of time for which the fire burns. The combustible equipment that can be contained in the building include: furniture, papers, window curtains, equipment in the office, attires, wall and floor finishes, combustible gases and combustible liquids. The rate of burning and

the intensity of heat generated depend on the type of the combustible material; for instance, inflammable liquids or plastics produce a lot of heat as compared to combustible materials made of wood, paper or fabrics. In addition, plastics and combustible liquids release more toxic smokes.

Each building contains a relative quantity of fuel load; however, special consideration should be given to buildings that store or process a great amount of inflammable commodities that can easily trigger a fire incident and cause major damage to life, property and the environment. Therefore, buildings that have a higher fuel load are more susceptible to fire risks than buildings which are not. It is recommended that these buildings should be fitted with fire sprinklers so as to contain the fire in case of any fire risk.

2.10.5 Major socio-economic factors

Many socio-economic factors are associated with increasing fire incidences amongst countries with respect to different areas of such countries (Corcoran, Higgs & Higginson, 2011). Responsible factors range from social to economic aspects as well as the political factors that may initiate the burning of houses, hence leading to loss of lives and property (Jennings, 1999). They are determinants of the rate of fire incidence as well within a residential area. The following gives a discussion of some of the factors that affect the incidences of fire in residential buildings in various places within varied economies (Mysoerekar, 2006).

Socioeconomic factors are the common predictors of dwelling fires at a neighbourhood level. Even though building structures have major impacts on fire incidence, currently the greater significance is given to how people use and maintain these buildings (Shaenman et al., 1987, p. 4). Nowadays most incidences of fire are

as a result of cooking, heating, acts of arson, smoking and other causes that are directly linked to human activities. These causes account for over 60 percent of the global residential fires (Department of Homeland Security, 2006).

Many research studies on the socioeconomic factors to dwelling fire were carried out and published during the 70s and early 80s. Since then the studies that have been carried out are mostly unpublished academic works limiting their availability to policy makers and other researchers (Fox and Billie Ann, 1995, p. 752). Even though the earlier studies are very significant in advancing our understanding of the socioeconomic factors related to dwelling fires, the further studies is necessary to authenticate the persisting relevance of their relationships. Likewise, shifts in population have considerably transformed the earlier communities and this means that studies have to be repeated to confirm the impact of these changes (National Fire Protection Association, 1996, p. 2).

Many studies on socioeconomic factors have directly or indirectly linked dwelling fires to lower levels of income. Earlier studies attempting to quantify these relationships had a number of significant findings. For instance, a study conducted by Shaenman et al. (1987) established that inter-city comparison of resident fire rates was irrelevant. They found out that considerable variation in the fire rates in different cities made it very difficult to use socioeconomic factors to explain disparity in dwelling fires across these cities. As a result, they refocused their efforts on inter-city disparities in resident fire rates, employing census tracts as a basis of analysis (Shaenman et al., 1987, p. 6).

In their study, Shaenman et al. (1987) established that three elements were most effective in explaining disparity in fire rates among different cities. These

included parental presence, poverty and school drop-out level/under-education (Shaenman et al., 1987, p. 6). In addition to the above three variables, they also covered seven other variables but shallowly; these included: home ownership or the number of houses occupied by the owners; good quality education, or the number of individuals over the age of 25 with at least high school education; satisfactory income, or annual household income of over fifteen thousand dollars; housing crowdedness; a variable for the interaction of education and race and lastly a variable for race and poverty. They found that each variable accounted for at least 20 percent of dwelling fires in U.S (Shaenman et al., 1987, p. 7; Karter and Donner, 1978, p. 55).

Income

Income refers to the disposable amount of money or the per capita income that an individual has to use in the purchase of goods and services (Mysoerekar, 2006). In most cases, different economies and nations have varied ways of determining the level of income that a community will be able to dispose of. Such a disposable amount is very influential in the buying behaviour of individuals within the community (Corcoran, Higgs & Higginson, 2011). All these are categorised under the income determinant of fire incidence within the city. Each factor however has the potential of enhancing the increase in the fire incidence. Poor housing quality gives buildings which are more prone to fire incidence (Donnell, 2009). It is important that everyone within the economy has a proper and sufficient disposable income that will guarantee the purchase of the required equipment and meeting of the various needs within living standards (DiGuisseppi et al., 2002).

Income determination criteria are determined by a nation's per capita income that it has and the available disposable income per individual (Donnell, 2009). It is also determined by a country's Gross Domestic Product and how the income distribution is achieved within the economy (Al-Homoud, Abdou and Khan, 2002). There are various ways through which nations and economies are able to differentiate between the poor and the rich with regard to income levels (DiGuseppi et al., 2002). Such income levels affect the purchasing power of individual hence the availability of firefighting equipment and the other factors affecting the incidences of high rates of fire.

Income is the most influential factor that affects many operations within an economy especially amongst its citizens (Corcoran, Higgs & Higginson, 2011). Availability of income presents itself as a solution to many issues and problems that mostly befall a community, especially with regard to fire. Income is required for different purposes towards attaining the fire incidence reduction within economies (Huang, 2009). Research has shown that places inhabited by low income earners are more prone to fire than those places inhabited by high income earners (Slovic, Fischhoff and Lichtenstein, 2005). Availability of or level of income is such an important factor in this area because the low income earners lack the required resources meant to purchase or obtain the required resources for maintenance and prevention of fire incidences.

Other than the fact that income levels affect most of the factors that fuel the incidences of fire, the income levels are also very influential in ensuring that all the possible preventive measures regarding fire incidences are taken (Jennings, 1999). Low income would mean low measures for preventing the rate of fire incidences

while high income results in better measures for protecting households against the rate of fire incidences (McCoy, 2004).

Poverty

Poverty refers to the state or condition of having little or no money, goods, and other basic needs that an individual requires in order to live a normal life (Mysoerekar, 2006). Poverty is usually as a result of low income, and is caused by many factors including drought and poor economy growth. Other reasons leading to the poverty of an individual include a lack of basic forms of necessities such as education and healthcare provisions, hence leading to detrimental effects on the lives of individuals within a given society (Donnell, 2009). Poverty has been proved to be at the forefront in leading to some of the disadvantages faced by individuals, one of these being the increase in rates of fire incidences (Al-Homoud, Abdou and Khan, 2002).

Poverty has caused many people to be very ineffective in achieving and attaining the required basic needs and demands that are essential in fulfilling some aspects of life (Corcoran, Higgs & Higginson, 2011). Without these basic needs it becomes difficult for an individual or even a community to invest in other things such as the purchase of fire equipment and involve the members of the family and the community as well in other necessary services and needs such as education and healthcare (Donnell, 2009). This has been a particularly salient fact in the increase in the rate of fire incidence rates within a community. It is therefore important to ensure that certain factors, needs, and wants are achieved within a community with an aim of reducing effects of certain incidences through investments in such areas as fire preventions and reduction (Al-Homoud, Abdou and Khan, 2002).

Moreover, poverty affects other things such as education, which are determinants of high rates of fire incidences within economies (Huang, 2009). Residential places where the occupants have a high rate of poverty have higher rates of fire incidences. The poverty level is a determinant of acquisition of other equipment essential for the prevention of the fire incidence rate; hence the rate will be high where the poverty level is high (Slovic, Fischhoff and Lichtenstein, 2005).

Poverty is as a result of income disparity: hence it will affect the rate of fire incidences in almost the same way as low income would. Poverty affects the rate of fire incidences in a directly proportional way: that is, the higher the rate of poverty the higher the rate of fire incidence (Huang, 2009). Poverty will influence the type of structure in which a person and their family live, as well as the availability of other resources that are meant to be used for the prevention of increases in rates of fire incidences (Slovic, Fischhoff and Lichtenstein, 2005). The type of structure influenced by the types of an individual affect the rate of fire incidences as described below.

Unemployment

Unemployment is a socio-economic factor that has many adverse effects, and unemployment within different economies and nations has been demonstrated to be the cause of many social decay and immorality (Häkkinen, 2011). Unemployment in any community refers to the number of people who have the ability to be employed but are not in any income generating activity (Yang, Chen, Yang & Fang, 2005). All these factors are categorised under the income determinant of fire incidence within the city. Each factor however has the potential to increase fire incidence. Poor housing is more prone to fire incidence (Donnell, 2009). This results in low income

levels leading to an inability to purchase the required equipment for reducing the effects of fire incidences (Huang, 2009). Unemployment determines the rate of fire incidences within a given residential area or community by affecting various factors responsible for influencing fire incidence rates (Slovic, Fischhoff and Lichtenstein, 2005).

Other than determining the rate of poverty within a given community, unemployment will also influence the household population and the structures of buildings (Donnell, 2009). Unemployment forces a given family to share a small house, hence increasing the number of persons within houses and this gives rise to higher rates of fire incidences (Corcoran, Higgs & Higginson, 2011). The types of housing structures where unemployed persons live are usually of low quality materials and this has a potential for increasing the rate of fire incidences within a given community (Slovic, Fischhoff and Lichtenstein, 2005). Hence, unemployment has the potential of affecting the rate of fire incidences in any given environment.

Housing Structure

Housing structure may be looked at in two perspectives; either considering owner occupied or rented, or the second perspective of considering the materials used in the building of the houses (Häkkinen, 2011). A rental house is more prone to high rates of fire incidences since the tenants usually are not so concerned with the safety of the houses, as after all they can always move to another place (Al-Homoud, Abdou and Khan, 2002). Building structures composed of poor materials are very prone to fire attacks just like poor quality housing as a result of poor building systems, techniques, or strategies (Been, 2004). An absence of equipment for firefighting within the building increases the rate of fire incidence. Houses occupied

by owners are less prone to high rates of fire incidences due to the fact that the owner understands that if the house is burnt down, he or she will have no place to go: hence the need to take serious measures in mitigating risks associated with fire incidences (Yang, Chen, Yang & Fang, 2005).

The second perspective considers the characteristics of a house in terms of the materials used in building it. There are some materials that are prone to high rates of fire incidences and therefore any housing structure built with such materials tend to be affected by fire more often (Slovic, Fischhoff and Lichtenstein, 2005). For instance, in places where the houses are grass thatched then there is a high risk of the houses being brought down by fire, unlike places where the houses are built with tiled roofs. They are determinants of the rate of fire incidence as well within a residential area (Mejía, Valeriob & Coronado, 2005). Places where there are a great many houses built of such fire prone materials are at higher risk of structures being burnt down by fire as compared to other places with many permanent structures (Al-Homoud, Abdou and Khan, 2002). In addition, when one house is under fire it becomes very easy for the fire to spread to other places: hence building materials that form part of housing structures are determinants of the high rate of fire incidences.

Housing types

Housing types refers to the type of building that exist within a given place, such as flats, bungalows and villas. Housing types have a direct relationship not with the rate of a house being on fire but the rate at which fire spreads (Rowland et al., 2002). Areas with flats have high rates of fire incidences in terms of fire spread as it is easier for other neighbouring houses to catch alight from the same fire

(Diamentes, 2005). Fire spreads faster where there are closely spaced houses as opposed to places in which the houses are far apart. Therefore, housing types have an effect on the rate of fire spreading from one house to the.

Another way through which fire incidence rates are affected by housing types is in the putting out of the fire and the rate at which property is destroyed and lives lost (Mejía, Valeriob & Coronado, 2005). Fire incidences within flats are very difficult to control since they spread very fast: hence leading to a massive destruction of property and loss of life (Slovic, Fischhoff and Lichtenstein, 2005). Building structures composed of poor materials are very prone to fire attacks, in the same way as is poor quality housing as a result of poor building systems, techniques, or strategies (Been, 2004.). The absence of equipment for firefighting within the building increases the rate of fire incidence. The time taken to put out fire in residential areas which are made up of flats is very long, resulting in enormous destruction of property and loss of lives.

Housing Population

Housing Population is another determinant of high rates of fire incidences that can be looked at from two perspectives. The first perspective is that of the numbers of persons living in a given house while the second perspective is the identification of the type of persons within a given house (Slovic, Fischhoff and Lichtenstein, 2005). Availability of income is presented as a solution to many issues and problems that may befall a community: especially with regard to fire. Income is required for different purposes towards attaining a fire incidence reduction within economies. Whether number or type, the housing population is a determinant of high rates of fire incidences within residential areas in an economy (Huang, 2009). When there is an

excess number of persons within a given house: that is, the house being overcrowded, there is a possibility of high rates of fire incidences (Jennings, 1999). This is because overcrowding may lead to poor fire prevention measures due to irresponsibility amongst the persons in the house as a result of a 'war of attrition'.

The other way of looking at the housing population in terms of overcrowding is to examine the number of houses within a given residential area (Mejía, Valerio & Coronado, 2005). The more the houses within a residential area, the higher the rate of fire incidences in terms of fire spreading (Rasbash and Ramachandra, 2004). Housing overcrowding makes putting out a fire difficult as some houses may be unreachable by the fire fighters and equipment (Jennings, 1999).

Housing population in the second perspective involves the kind of persons present in the house. It includes the elderly, children, and single parent houses (Jennings, 1999). Single parent headed-houses are prone to high risks of fire incidences due to low affluence contributed to by a one-sided income. In addition, the presence of children increases the risk especially in a single parent headed-house (Jennings, 1999). This is because presence of children is a high risk as they like playing with fire equipment and so when there is only one parent, the possibility of leaving the child alone is high. This means there will be increased risks of fire incidence in such scenarios (Slovic, Fischhoff and Lichtenstein, 2005). Elderly presence and overcrowding of a house increases the risks as the elderly, like children, may not find it easy and comfortable to handling a fire situation.

Demographics

Demographics is a wide concept that needs to be understood with some precision. It entails all the characteristics of human beings from their number to the various

activities that they engage in (Corcoran, Higgs & Higginson, 2011). Demographics is a concept that entails the interactions between different persons within a given community representing the available persons in terms of age, gender, and educational level. It really contains the whole aspect of human beings with regard to their interactions and interrelations (Mejíaa, Valeriob & Coronado, 2005). With demographics it becomes easy to understand the behaviours of a person and the way in which a community operates (Rowland et al., 2002). Most of the variables within communities, and especially with regard to behaviour and the other necessary activities are determined by demographics.

Demographics represent the number of people living in a given environment or the number of people living in a given house. The latter has been discussed under the housing population and how higher numbers results in higher rates of fire incidences (Runyan, Bangdiwala, Linzer, Sacks & Butts, 1999). When the number of persons within a given environment is high there is likely to be overcrowding and this is a serious determinant of high rates of fire incidences (Jennings, 1999). The higher the number of persons within a given environment, the higher the incidence of fire that is likely to consume such an area (Huang, 2009). This is because once one house is on fire, there is a high possibility of the other houses within the vicinity also being affected by the fire.

Overcrowding may prevent the fire extinguishers from reaching certain houses and this is very detrimental as it may lead to serious destruction of property and loss of lives (Huang, 2009). Places where there are many houses tend to be very inaccessible: hence once a fire starts destroying property it becomes very

difficult for fire fighters to put out such a fire (Jennings, 1999). Consequently, the fire will consume an enormous amount of wealth and lives.

Unattended children

Unattended children have the tendency to play around with fire appliances and this may be destructive in terms of fire incidences within a household (Huang, 2009). Research has shown that households with children who are unattended tend to have higher rates of incidences of fire as the children do not know or understand the effects of playing with fire. The moment children play with fire appliances there is a high probability of causing outbreak of fire: hence causing higher rates of fire incidences (Jennings, 1999). The higher the number of persons within a given environment, the higher the incidence of fire that is likely to consume such an area (Mejía, Valeriob & Coronado, 2005). For instance, if there is a lit candle in a house and there is a child who is unattended, then there is a probability that the child will reach for the candle as a playing object and in the process the candle may set light to some other objects, possibly leading to a serious fire that consumes property, and in most cases such children end up dying in that fire (Caufield, 2002).

Education level and attainment

Education is affected by income and poverty as stated earlier. Educational level is directly related to a high level of fire risks (Yang, Chen, Yang & Fang, 2005). When a person has a lower level of education there is a likelihood that he or she may not be able to use some of the appliances effectively, hence posing a high risk for the rate of fire incidences within the households (Huang, 2009), a reflection of the fact that education covers the whole aspect of human beings with regard to interactions and interrelations. Availability of income is also related to education and is a solution to

many issues and problems that occur within a community, and especially with regard to fire. Income is required for different purposes towards attaining the fire incidence reduction within economies (Caufield, 2002). Education level is an important factor in many areas and not only in mitigating the risks associated with fire incidences.

A community with high literacy levels have the tools and weapons to ensure that protective measures are put in place against risks associated with fire (Rowland et al., 2002). On the other hand, highly illiterate people will not have the basic knowledge required in putting up measures necessary for the purposes of reducing risks associated with fire incidence rates (Yang, Chen, Yang & Fang, 2005). As such, when the education level of an individual or a community is low then there is likely to be increased rates of fire incidence, unlike when the education level is high (Jennings, 1999). This is because of the skills, knowledge, and expertise in combating various fire incidences.

Alcohol, Drug and substance misuse

Use of alcohol, drug and substance misuse has been proved as an effective determinant factor in the high rates of fire incidences (Al-Homoud, Abdou and Khan, 2002). When a person uses drugs and other substances he or she tends to be careless and ineffective. The carelessness may lead to higher rates of fire incidences especially when the concerned parties are heads of families (Yang, Chen, Yang & Fang, 2005). Carelessness will lead to an individual not to attend to the children and this may pose serious threats and challenges as far as rates of fire incidences are concerned (Al-Homoud, Abdou and Khan, 2002). This carelessness can also be translated into the actions of an individual: especially when handling fire

appliances, and this creates more chances for fire outbreaks: hence becoming a factor in determining the rate of fire incidences (Jennings, 1999).

Consumption of alcohol and use of other drugs has been proved to be one of the factors that causes poverty within a given group of persons (Caufield, 2002). This is because a lot of money is spent in the purchase of the alcohol and other drugs (Yang, Chen, Yang & Fang, 2005). As a result, there will be little money for taking care of the fire safety equipment required, and this creates more loopholes for fire outbreak: hence being a factor determining the rate of fire incidences (Bergman & Brismar, 1993)

Smoking and related issues

Smoking and other related issues are also factors that affect the rate of fire incidences within a given environment. Smokers can be careless with the remains of their cigarettes after they have finished smoking them, and in many cases through the finished cigarettes aimlessly (Slovic, Fischhoff and Lichtenstein, 2005). The remains of cigarettes have the ability and potential for starting a fire whenever they are thrown. This may lead to the fire started in such a way spreading to other places and hence increasing the rate of fire incidences. Smoking, just like the consumption of alcohol, also diverts resources meant to be used for necessities, including for the purposes of obtaining fire safety equipment (Al-Homoud, Abdou and Khan, 2002). Fire spreads faster where the houses are in close proximity; i.e. terrace houses or flats in high density neighbourhoods in comparison to the houses are far apart such as detached houses. Moreover, some substances are highly inflammable: hence smoking next to such a substance would lead to fire outbreak and this may cause much destruction and loss of property and lives (Runyan et al., 1999).

Accessibility and road infrastructure

Accessibility and road infrastructure affect the rate at which fire service personnel can get to the source of fire outbreaks and put fires out (Slovic, Fischhoff and Lichtenstein, 2005). When there is poor road infrastructure there are likely to be problems in reaching places which are on fire, and hence the rate of destruction will be very high and this will cause much destruction of property and loss of life (Al-Homoud, Abdou and Khan, 2002). The higher the number of persons within a given environment, the higher the incidence of fire that is likely to consume such an area. Accessibility may be hindered as a result of high population within a given environment. Such high population causes overcrowding, resulting in inaccessibility of the place and when there is a fire outbreak it becomes difficult to put it out (Häkkinen, 2011). As a result the level of destruction attained will be much higher.

Misuse of domestic appliances

Misuse of domestic appliances; i.e. heaters, cooking appliances, electrical appliances, is another factor that affects the rate of fire incidences, and especially within the household (Diamantes, 2005). Misusing such appliances has the possibility of leading to a high rate of fire incidences as these appliances may cause the start of a fire within a given home (Häkkinen). It is important that all the directions associated with the use of a domestic appliance are followed within households, to reduce the risks associated with fire incidences (Slovic, Fischhoff and Lichtenstein, 2005). Domestic appliances therefore, and especially those that are directly involved with fire, should be handled with a great deal of care, thus reducing the rate of fire incidences within the household.

Storage of inappropriate substances at home

Some substances are highly flammable and hence their inappropriate storage may lead to high rates of fire incidences (Mejía, Valeriob & Coronado, 2005). Fire spreads faster where there are close houses than when the houses are far apart, and such substances may have the potential for starting a fire, which may lead to the further destruction of the household and the neighbourhood (McCoy, 2004).

Fire is a natural disaster with the potential for destroying property and causing loss of life (Häkkinen, 2011). Many regions experience the consequences of fire, and this is especially so within industrial and residential areas (Sanderson, 2007). Fire is not always a natural disaster, and while it may be caused naturally from volcanic eruptions for example, it may also be caused by human activities.

Reduction in the level of income has the effect of increasing the rate of fire incidences since an individual will not be able to purchase the requisite fire safety equipment to protect against such occurrences or their escalation (Mejía, Valeriob & Coronado, 2005). There are various causes of fire which stretch from socio-economic factors to political, cultural, and environmental factors. Human actions have been at the front in causing fire, and this is especially so within residential areas.

Low socioeconomic status has widely been identified as a risk factor for fire incidences not only in the developing countries but also in the developed countries (Boyce and Shield, 1999). Without taking caution in relation to human actions and behaviour it will be difficult to attain the fire safety status that is intended to be achieved within a given environment by the concerned bodies (Wertz-Kanounnikoff & Chomitz, 2000). All the other factors that cause high rates of fire incidences emanate from the actions of human beings, such as in the case of political factors

that are as a result of the political behaviour of individuals within a given environment (Sanderson, 2007).

Fire outbreaks have been proved to be amongst the most notable and formidable natural disasters in terms of causing property destruction and loss of life. In recent years, a great deal of destruction has been experienced due to fire outbreaks, and this calls for a study to identify some of the possible reasons as to why this has been so (Bergman & Brismar, 1993). Fires in residential dwellings are a representation of about 70% of the fire incidences experienced in the whole global economy, indicating that much of the fire that consumes property and destroys life is as a result of residential fire outbreaks (Häkkinen, 2011).

Many cases of property loss, injuries, and deaths due to fire have been reported on an increasing scale especially within the last few years (Caufield, 2002). This has created some fear within various governments and bodies concerned with the fire incidence rates, and these bodies have decided to take measures to curb the effects and impacts of such fire outbreaks (Häkkinen, 2011).

As a result there has been increased study to identify the various causes of fire incidences within various environments with specific targets concerned with residential areas since it was proved that most of the fire outbreaks occurring come from such areas (Bergman & Brismar, 1993). This has been one of the studies to identify the real factors with the potential for affecting the rates of fire incidences within such residential areas (Wallace, 1991). Many factors have since been identified, such as income, poverty, unemployment, poor storage of some substances and especially of highly flammable substances, and the use of drugs such as alcohol and cigarettes.

Other factors identified include the population within a given area, also known as the demographic of that area, as well as the housing characteristics present (Chandler, Chapman and Hollington, 2001). Housing characteristics encompass the population within each household, the structure of house, and the kinds of persons living in those houses.

It is desirable in identifying how each of these mentioned factors influence the rate of fire incidences, and especially with reference to the residential areas (Caufield, 2002). It has been necessary to come up with various ways and techniques of reducing risks associated with the high incidences of fire, based specifically upon knowledge of fire and factors influencing its high incidence (Bergman & Brismar, 1993).

Many factors have been identified as socially and economically effective in influencing the rate of fire incidences. Huang (2009) identifies one of the factors as income, which is responsible for influencing the purchasing actions of consumers. High income has the ability of increasing the purchasing power of consumers and hence enabling them to acquire some useful equipment and in particular, fire safety equipment. As a result, Jennings (1999) confirms that the rate of fire incidence within residential areas increases with a reduction in the levels of income. On the other hand, Slovic, Fischhoff and Lichtenstein (2005) propose that inadequacy of income within a family will result in poor living conditions, and such conditions are factors that influence the rate of fire incidence within residential areas.

Amongst the poor living conditions that increase the rate of fire incidence within a given environment are included poor structures, living in a small house with too many people, and the types of houses. Yang, Chen, Yang & Fang (2005) believe

that housing structures and types are also factors that influence the rate of fire incidences. According to Yang, Chen, Yang & Fang (2005), when a family lives in poor structures there is a high possibility that these will be brought down by fire. Moreover, types refers to the type of houses that a family lives in: for instance bungalows, maisonettes, or flats (Sanderson, 2007). When a family lives in a flat, then when there is a fire outbreak it is likely to spread faster and wider than in an environment where the residential area is in the form of maisonettes, bungalows and villas (Rowland et al., 2002). A higher number of persons within a given environment leads to a higher incidence of fire that is likely to consume such an area.

Housing population and demography are other factors that affect the rate of fire incidence within residential areas. When a house accommodates many people, and especially when the numbers housed are greater than the required capacity, the possibility of fire incidences is higher than when a house accommodates the required number of persons (Wallace, 1991). Moreover, demographics affect the accessibility of a place, and especially when there is a fire outbreak. It really contains the whole aspect of human beings with regard to interactions and interrelations.

Overcrowded places tend to be inaccessible, and hence extinguishing fire may be difficult and cumbersome (Bergman & Brismar, 1993). The higher the number of persons within a given environment, the higher the incidence of fire that is likely to consume such an area, and consequently also, the fire will be able to cause a considerable level of destruction and loss of life and hence the incidence will be high. Rates of fire incidences are high when there is overcrowding of homes or houses since the fire outbreak spreads faster.

Other than inadequacy in income determining the living standards and thus leading to high rates of fire incidences, there are other factors that are directly related to income and influence the rate of fire incidences; poverty and unemployment (Wertz-Kanounnikoff & Chomitz, 2000). Like inadequate income, poverty and unemployment tend to be responsible for affecting the rate of fire incidences. Poverty and unemployment will affect the purchasing power of various individuals hence affecting the availability of the fire safety equipment and this has the possibility of increasing the rate of incidence. Another factor that is caused by poverty and results in high rates of fire incidences is the poor educational level (Federal Emergency Management Agency, 1997). Educational level is an important factor in determining the rate of fire incidence (Häkkinen, 2011). When the rate of literacy within a given community is high there is a possibility that there will be reduced rates of fire incidences (Runyan et al., 1999).

Other factors that affect the rate of fire incidences include the consumption and use of alcohol and misuse of drugs and related substances. Apart from the alcohol and the drugs making an individual incoherent and irresponsible, they also make people poor, as some part of the income is used for the purchasing of the drugs (Wertz-Kanounnikoff & Chomitz, 2000). The combination of carelessness, irresponsibility, and lack of adequate resources has the potential of increasing the rate of fire incidence within residential areas (Chandler, Chapman and Hollington, 2001). Drugs such as cigarettes have the ability for starting a fire and this influences the rate of fire incidences within residential areas. In addition to these factors, arson, misuse of domestic appliances, urbanization, unattended children and using residential address for commercial purposes are other factors that influence the rate of fire incidences (Caufield, 2002).

Most of these factors are categorised as political, social, economic, environmental, and natural causes (Federal Emergency Management Agency, 1997). Other than natural causes, the other categories of causes are related to socio-economic factors either directly or indirectly (Bell, Schuurman & Hameed, 2009). Some of the factors identified include income, poverty, unemployment, arson, housing characteristics, domestic appliances, unattended to children, and educational levels and also include demographics, social deprivation, and storage of inappropriate substances within households (Runyan et al., 1999).

Any discussion of these socio-economic factors may be dependent on the context and the effects of the factors in influencing the rates of fire incidences within residential areas (Bell, Schuurman & Hameed, 2009). Most of these factors are very much interrelated however and this makes the understanding of the factors relatively easy and clear (Sanderson, 2007). For instance income, poverty, unemployment, educational level, and housing characteristics are interrelated and this makes understanding of the various factors and their influence on rates of fire incidences simpler (Chandler, Chapman and Hollington, 2001). Income affects the rate of purchasing power just as unemployment and the poverty factors. In any case, the determinant and measurable factor for unemployment and poverty is income; lack of income leads to poverty and unemployment leads to lack of income (Federal Emergency Management Agency, 1998). Fire spreads faster where there are closer houses than when the houses are far apart. Such interrelations bring out the various ways through which the rates of fire incidences are influenced more clearly (Bell, Schuurman & Hameed, 2009).

There are factors that are directly proportional to rates of fire incidences while some are indirectly proportional to the rates of fire incidences (Runyan, Bangdiwala, Linzer, Sacks & Butts, 1999). Reduction in the level of income has the effect of increasing the rate of fire incidences since an individual will not be able to purchase the fire safety equipment (Bell, Schuurman & Hameed, 2009). Unemployment on the other hand leads to increased rate of fire incidences within residential areas. Poverty has the same effects with unemployment (Chandler, Chapman and Hollington, 2001). Availability of income is like a solution to many issues and problems that can befall a community: especially with regard to fire. Income is required for different purposes towards attaining a fire incidence reduction within economies (Caufield, 2002).

The other factors such as misuse of domestic appliances, and especially those that deal with fire, influence the rate of fire incidences within residential areas. The higher the number of persons within a given environment, the higher the incidence of fire that is likely to be seen in such an area. Educational level has a direct influence on the rates of fire incidences although in an indirect proportion where an increase in the level of literacy leads to an increase in the rate of fire incidences (Caufield, 2002).

To understand the variation of dwelling fires across different neighbourhoods, it is significant to understand how neighbourhood class is linked to dwelling fires. In general, the quality of the neighbourhood is mainly linked to its housing stock and significantly determines the rate of dwelling fires. The quality of the housing stock, nevertheless, can be reduced by the inter-linked processes of dwelling fires and building abandonment (Clark, 1982, p. 41). The most commonly asked question is

what makes poor neighbourhoods more susceptible to resident fire threats than other neighbourhoods. The answer to this question lies in the following explanations.

Many neighbourhoods in major cities tend to be separated based on income levels. Poor neighbourhoods are mostly characterized by vacant and abandoned buildings in comparison with other residential neighbourhoods. These vacant and deserted buildings present a great fire hazard for a number of reasons. First and foremost, they have a higher probability of catching fire than any other buildings (Sternlieb and Burchell, 1973, p. 28). According to Fox and Billie Ann (1995), vacated buildings were four times more prone to fire hazards than other structures. In addition, homeless individuals or those seeking shelter in such buildings normally contribute to fire hazards. This is mostly prevalent during the winter when those seeking shelter illegally in these buildings light a fire to keep themselves warm. In many cases, these homeless individuals or those seeking shelter in these buildings are under the influence of hard drugs or alcohol. There is always an additional risk of the careless use of smoking materials which can ignite a fire very easily (Alison, 1989, p. 33).

Vacant and deserted buildings can result in a self-fulfilling prophecy for a neighbourhood. The presence of such buildings in a neighbourhood often discourages owners, who in many cases do not live in the neighbourhood, from investing more in their buildings. As a result, the buildings in such neighbourhoods are often neglected, compromising their quality, and thus increases the risk of fire from poorly maintained electrical and heating systems (Massey and Denton, 1993, p. 132). In extreme cases, the owners of these buildings may resort to acts of arson to force the occupants out or to deceitfully collect an insurance policy. Such acts also

contribute to more vacant or deserted houses in the neighbourhood (Sternlieb and Burchell, 1973, p. 30).

Similarly, besides pulling out by the private investors in such neighbourhoods, large institutions such as banks, mortgage financiers, and insurance companies can follow the trend. Countries which lack legislation barring these institutions have been reported to lawfully decline to underwrite mortgages or fire policies for people living in such neighbourhoods. This has made it hard for other owners who are willing to reinvest in their buildings since they have no access to capital. In addition, these owners are often discouraged from reinvesting in their buildings because, without access to capital, they are not likely to recover their investment in the case that they decide to sell their property (Massey and Denton, 1993, p. 135). Therefore, lack of access to credit facilities plays a significant role in the vacation and desertion of buildings and neighbourhood decline in the deprived neighbourhood. On the other hand, vacation and desertion increases the risks of fire hazard from arsonists and careless homeless individuals or shelter seekers (Alison, 1989, p. 37).

Arson is a major cause of fires and fire hazards in many urban areas. According to Federal Emergency Management Agency (1997) arson and cooking fires are the leading cause of dwelling fires in cities, each accounting for 25 % of the fires. In the U.S., arson is ranked third among the leading causes of dwelling fires, accounting for only 15% of fires. In 1995, arson accounted for a quarter of dwelling fire deaths in metropolitan areas. On the other hand, the number one cause of dwelling fires in the U.S during that time was careless smoking which accounted for

approximately 25 percent of the deaths (Federal Emergency Management Agency, 1997, p. 8).

Fox and Billie Ann (1995, p. 754) emphasise the relationship between arson and the income levels of different neighbourhoods. They established that among all the causes of fire which they had studied, the relationship between arson and income was the most dramatic. It was further found that incendiary or suspicious fires were more prevalent among the low income neighbourhood. When the authors compared this prevalence rate with the high income neighbourhood, the low income neighbourhood had a 14 times higher prevalence rate than the high income neighbourhood (Fahy and Alison, 1989, p. 31).

Besides arson and abandoned buildings, the quality of the neighbourhood can have impacts on fire safety in numerous other ways. Since these neighbourhoods normally experience higher rates of crime, households may seek to barricade their houses for safety reasons. This is usually accomplished by installing metallic grills on the doors and windows or by resorting to unorthodox means, for instance, use of furniture to block the passageways. In the event of a fire tragedy, such barricades normally make it very difficult for those inside the buildings to escape or salvage their properties, and thus this action increases the risk of fire-related injuries, deaths and loss of properties (Federal Emergency Management Agency, 1997, p. 11).

Socioeconomic factors at the level of the household include the quality of individual housing units, affordability of these housing units, and the social structures of the households living in these housing units (Fahy and Alison, 1989, p. 32). In many countries the quality of housing and affordability goes hand in hand. The value

of the housing unit is generally pegged on the quality of the unit given its location and social amenities among other factors. For that reason, only high income households can afford to live in those housing units as opposed to the lower income households (Federal Emergency Management Agency, 1997, p. 13). Housing Units and affordability are discussed separately to explore their distinctive relationship with levels of income and dwelling fire risks.

Income is the fundamental determinant of the housing quality for many households. In many cities, low income households usually live in the oldest and most dilapidated sections of the city's housing stock (Fahy and Alison, 1989, p. 33). The conditions of buildings built four to five decades ago in most cities have deteriorated with time. The increased gap between the rich and the poor in developing and developed economies means more people will turn to these housing units for economic reasons (Fox and Billie Ann, 1995, p. 756). The old and poorly maintained housing units increase the risk of fire hazards for various reasons. First, the electrical and heating systems in these buildings are either aged or in very poor condition and this increases the risks of mechanical malfunction and probability of fire (Fahy and Alison, 1989, p. 33).

Secondly, the electrical system of the old housing units poses a high risk of dwelling fire. This is because they were not designed to accommodate the electrical load of the contemporary gadgets and appliances, for instance, stereo systems, washing machines and microwave ovens, among others. Excessive loads posed by these gadgets and appliances can result in an electrical fire. Correspondingly, the occupants of these buildings may attempt to offset the inadequacy of the electrical systems of these buildings by running extension cords and straining the available

electrical outlet, thus causing socket or circuit overloads which can set off an electrical fire (Shaenman et al., 1987, p. 7).

Thirdly, the risk of fire can be increased by households who attempt to compensate for insufficient heating system through stop-gap measures, for instance, space heaters. Space heaters and other forms of heating devices enhance risk of fire in various ways. When these devices are old or poorly maintained they can ignite fire. In addition, incorrect use of these devices, for example near inflammable materials, poor ventilation or by young children also increases the risk of fire (Sternlieb and Burchell, 1973, P. 30).

A noteworthy exception to the relationship between income level and fire hazards and poorly maintained old housing stocks arises in a case where the household receives housing assistance from the state. For instance, In the U.S. the old public houses better known as 'projects' are more well maintained than most of the privately owned apartment buildings affordable to those households with low income. Therefore, these housing units are less prone to resident fires resulting from malfunctioning heating and electrical systems. In addition, households that receive rental subsidies and vouchers have low exposure to fire risks since they are able to keep their houses in good condition (Fox and Billie Ann, 1995, p. 759).

The quality of the furnishings, just as the quality of the housing unit, can also affect the risk of resident fire. Nowadays, consumer products including the home furnishings have been improved for fire safety. For instance, the materials used to manufacture mattresses and upholstery are extra resistant to fire compared to those used before. Regrettably, households with higher incomes are most likely to

afford such products and therefore low income households are still susceptible to fire related risks since they cannot afford these products (Shaenman et al., 1987, p. 8).

2.11 SUMMARY AND CONCLUSION

Fire can be a natural or man-made disaster that has very destructive consequences, requiring precautionary measures in order to mitigate its occurrence. It is therefore imperative to have measures and systems in place that will reduce the impact of fire incidences: especially within the residential areas. Once the trends and relevant factors involved in fire are established and ascertained with the aid of the appropriate statistical tools as adopted and espoused in this study, then measures and systems can be put in place to contain and mitigate these.

Numerous factors influence the rate of fire incidences within residential areas, as observed in the data collected as part of this thesis. Such factors in the study of residential fires are categorised into political, technological, environmental, socio-economical, and natural causes (Caufield, 2002). Amongst all these categories, it is considered in this thesis that socio-economic factors have proved to be very significant.

Reduction in the level of income is assumed to have the effect of increasing the rate of fire incidences, since an individual will not be able to purchase sophisticated fire safety and fire fighting equipment. Fire spreads faster where there are close houses than when the houses are far apart (Bell, Schuurman & Hameed, 2009). Therefore, a deeper understanding of formulating a framework which can help to alleviate these the effects of these socioeconomic factors is a boost in the road to developing fire safety measures.

The recommendations and observations are meant to influence strategic decisions of National Planning with regard to firefighting, making such areas as deployment of fire fighters and equipment, budgeting, provision of training, calculation or determination of insurance premium, rents charged in high/low risks accommodations, housing allocations based on demography and development of fire code of conduct and ethics. From the observations in the literature reviewed during the course of preparing this thesis; it has been demonstrated that socioeconomic factors are very much influential when it comes to the factors in and rate of incidence of fire. Availability of income is seen as a solution to many issues and problems that often befall a community: especially with regard to fire. Despite the fact that there are other forms of causes of increases in the fire incidence rate, social and economic factors have proved beyond reasonable doubt to be the major influences on the rates of fire incidence. Social and economic factors are directly related to human behaviours and activities and this could be the reason as to why there have been the most influential factors within the community or society. Without appropriate measures, the increases in fire incidence will continue destroying property and claiming lives.

Fire prevention and fire safety for dwellings in the developing countries has been neglected in literature though it has been one of the oldest issues that causes a huge number of human lives to be lost and injures in big numbers. The literature review suggests that the economy is the main factor in providing fire safety in dwellings. That gives an indication of why more lives are sacrificed in fire incidents in developing world compared to the developed world. People of the developing world deserve high safety measures for avoiding fire incidents, hence the importance of investing in safety issues for dwellings should not be viewed from economic

perspectives. It is of prime importance for a developing nation like Saudi Arabia, to work towards introducing a comprehensive framework for fire incident management in order to deal with the risk of fire by the relevant authority. Therefore, investment from the Government to raise awareness as well as strategic planning to take precaution and preventive measures for fire incidents will reduce the number of fire incidents and fire incident victims.

Fire risk assessment is a process that entails scrutinizing and evaluating the various conditions that cause the community to be susceptible to fire hazards. In this regard, it is imperative to conduct an analysis relating to the chances of the fire risk taking place and the potential consequences that are associated with the risk. The term 'Risk' in the context of this study can be taken to mean the outcome of uncertainty on intentions. Uncertainties refer to events which have a possibility of occurring or not occurring, and these uncertainties exist as a result of limited information available or vagueness of the available information (Stone, 1993, p. 34; Smith, 1994, P. 3).

The probability level of fire risk is usually calculated with regard to the number of fire incidents experienced in the past. In order to estimate the probability level, it is important to have information or data relating to past fire occurrences. When estimating the level of risk probability, it is essential to use the rate of the incidents occurring as a guide. This rate varies from one community to another; hence, the study focuses on Saudi Arabia as the case study. The consequence level refers to the possible damages, losses or harmful repercussions that are connected with the occurrence of the event (Sternlieb and Burchell, 1973, P. 30). Consequence levels are computed after making proficient judgments and analyzing the past

incidences. When the probability levels and the consequence levels of the fire risk are allocated to the extreme effects of the risks associated with fire, then an overall level of risk is achieved (McEntire, 2004, p. 25); this can be analyzed through the utilization of the Risk Analysis Matrix tool. One benefit of the Risk Analysis Matrix tool is that it makes it possible for the categorization and ordering of the circumstances that necessitate the occurrence of the risks.

Socioeconomic factors are among the topmost predictors of residential fire risks at a community level. However, the relationship of socioeconomic factors and residential fire rates is even stronger at the household level (Federal Emergency Management Agency, 1997, p. 6). Even though the structural elements of a building and infrastructure significantly impact on the residential fire rates, of greater significance are the many ways in which human activities directly or indirectly affect residential fire risks (Clark, 1982, p. 12). The study has explored at length ways in which varying socioeconomic conditions of humans occupying a building or a neighbourhood significantly affects residential fire rates.

Careless smoking, incendiary or suspicious acts, cooking and children playing accounts for the majority of the residential fires. The addition of heating causes increases to the proportion of fire risk to over three quarters. Since most of the residential fires which occur are caused by human activities, public awareness and education represents the most significant path for minimizing the severity and incidence of residential fires.

Almost all the literatures on socioeconomic factors of dwelling fires shows the direct and direct correlation between lower income levels and increased rate of residential fire (Kirschenbaum, 2006, p. 111; McEntire, 2004, p. 22; (Federal

Emergency Management Agency, 1997, p. 3). These studies established considerable variations in residential fire rates in different neighbourhoods, households and individuals. Low income levels affect the capacity of individuals to purchase the fire protection devices and to afford quality housing. Many buildings in the lower income neighbourhood lack operational smoke detectors and have faulty mechanical and electrical system. This puts households and individuals living in these areas at a higher risk of residential fire. In addition, income levels also influence the quality of child care (Federal Emergency Management Agency, 1997, p. 15).

Parents living with low income are sometimes unable to provide their children with quality care, and as a result they may abandon or leave their children on their own while away on errands. Consequently, this increases the risk of children playing with fire. In many cases these parents have no other choice but to leave their children on their own. These parents normally make arrangements with their neighbours to look after their children in their absence or in emergency cases (Kraizer, 1990, p. 579).

Single parent households are also highly correlated with low income households. This is because there is only one parent who provides for the family and in many cases gets no support from elsewhere (Kraizer, 1990, p. 579). Overcrowding is also attributed to low income level and poverty. This is as a result of one of the survival tactics used by low income households to tackle the problem of affordable housing, which is sharing a housing unit with extended family or friends. The increased number of people living in one roof means more potential victims of residential fire. Income level is also correlated with the quality of housing, literacy

level and housing affordability, which are among the factors that influence residential fire risks (McEntire, 2004, p. 25). In a nutshell, all the socioeconomic factors affecting the rate of residential fire are linked to income levels, from the community to the individual level.

The study of various residential fire risks for various socioeconomic clusters is a significant direction for planning and targeting community education and outreach programmes for residential fire safety (International Federation of Red Cross, 2000, P. 4). For instance, communal campaigns targeting middle income individual and households should emphasize the significance of maintaining operational smoke detectors or fire alarms in their premises. On the other hand, residential fire risk reduction efforts in the low income areas must recognize the fact that households living in these areas are less likely to purchase or install fire protection devices because of their restricted budget. In addition, the socioeconomic stress associated with their lives also means that they are less likely to prioritize fire safety measures (Clark, 1982, p. 12; Stone, 1993, p. 34; Smith, 1994, P. 3). Therefore, the campaign programmers should consider the above elements when designing and implementing their strategies.

In the same way, to reduce the rate of children playing with fire, middle income neighbourhoods should be educated about the risks of abandoning children or leaving them on their own, even for a short period of time. Such strategies are not likely to work with low income groups who may abandon their children or leave them unattended because they have no other child care options (Kraizer, 1990, p. 590). The two scenarios illustrate that residential fire prevention measures must take into consideration the sensitivities, needs and concerns of various socioeconomic

groups, as shown by disparity in fire rates, diverse spread of fire causes, and the existence of distinctive fire risk factors in different neighbourhoods. However, the main challenge for policy makers and implementers is that of language barriers and a wide array of literacy levels (Department of Homeland Security, 2006, p. 32).

Similar to other risk reduction approaches, to reduce risks of residential fire requires a holistic approach. Risk is equal to the hazard (fire) and vulnerability of the people or community involved (McEntire, 2004, p. 24). Individuals and communities with adequate resources both economically and socially are highly likely to survive the effects of any form of disaster than the poor individuals or community. The most discrete way of dealing with residential fire risks is that of tackling the socioeconomic challenges starting from the community level, household level and finally at the individual level. Residential fire risk reduction measures must encompass poverty reduction, reducing congestion/overcrowding, increasing awareness and information, provision of basic education and the overall change in people's lifestyle (McEntire, 2004, p. 25). This will not only minimize the vulnerability of the targeted population but also reduce the probability of the fire hazard. The reduction of fire risk can be categorized into societal measures, physical planning, economic measures, engineering and construction, and management and institutional measures (International Federation of Red Cross, 2000, P. 4).

Nevertheless, additional research on the management interventions required to reduce the impact of socioeconomic factors related to increased residential fire rates needs to be carried out since most of the available literatures are more than two decades old. The relationships predicted in these literatures need to be replicated, first, to test the resilience of those relationships and to assess any

changes that may have taken place over time. These forms of studies are significant for the policy makers and the society at large in averting an increase in residential fire rates.

CHAPTER THREE: METHODOLOGY

3.1 INTRODUCTION

This chapter will deal with aspects highlighting the behind-the-scenes philosophy related to the investigation approach adopted. It will, therefore, detail and outline the parameters of the research approach and methodology, shed light on how the sample for the exercise was selected and explain all such related aspects. The previous chapters have already highlighted the lack of research in fire risk management, especially from a policy making perspective. Furthermore, the lack of research in the Saudi context has been highlighted with currently no study investigating the perceptions of key informants who may be involved in the policy making process relevant to fire hazard management. Although some quantitative analysis has been presented using secondary internal data sources in the previous chapter, the lack of primary research in general in the Saudi context has highlighted the need for an inductive based investigation. This chapter therefore will highlight the inductive based methodology adopted for this study.

The purpose of this chapter is to present the methodology used to conduct the research study. This chapter provides a description of the specific steps that were taken to address the research problem. Research is a methodical examination which clarifies and illustrates. It can manage observable phenomenon using a wide range of methodological tactics. Research methods are vital in developing new knowledge. The theory which described the research method or approach is Methodology (Creswell, 2009). Methodology is defined as the nature of research

design and methods. It is a research strategy that shows how research is to be conducted. Methods, on the other hand, are instruments employed in the collection and analysis data (Glesne, 1999). Saunders et al. (2003, p.3) describes research as: “Something that people undertake in order to find out things in a systematic way, thereby increasing their knowledge”.

Generally, there are two main aims for conducting research: the first is to find the best possible solution to an existing issue. The second is to contribute effectively to the body of knowledge in the field which is important to the author (Denzin & Lincoln, 1994). Therefore, this research combines the two aims and discusses issues related to the chosen research methodology, the data collection and analysis methods that are used to conduct the research study.

The role of the research work is to fill a gap in a particular subject and to ensure that something new and important has been added to the body of knowledge (Creswell, 2012). Glasser and Strauss (1967) describe the role of research as an attempt to increase the body of knowledge by discovering new facts or relationships through a process of systematic scientific inquiry. The expected end results of the research would be to discover new facts that will help to deal with the problem situation (Denzin & Lincoln, 1994).

Many authors and experts on social research agree on three main purposes of carrying out research, namely exploratory, descriptive and explanatory purposes (Saunders et al., 2003). In fact, Creswell (2012) points out that the purpose of an enquiry may change over time, which means a study may include more than one purpose.

This chapter first reviews and discusses some possible research designs and methodologies. The selection of approach will be justified in terms of its appropriateness and usefulness to the research project in order to achieve the study objectives. Also, this chapter describes the study population, sample selection, instrumentation and methods of analysis.

3.2. RESEARCH AIMS AND OBJECTIVES.

The underlying issue governing all aspects of this research, and this document could be stated as follows:

The broad aim of this study is to deconstruct the fire risk management process in the Saudi context. Understanding the key issues in this process is essential to help develop a national fire hazard policy. The investigation would therefore aim to determine the key themes necessary to effectively manage the fire hazard process. Furthermore, this study seeks the perspective of senior fire management staff who may be involved or have experience of designing such interventions to improve the fire hazard process.

On a corresponding note, the research objectives decided upon are listed below:

- Develop an understanding of the key management issues required for reducing fire risk or hazards in the Kingdom of Saudi Arabia.
- To determine if there is any relationship between the key management issues identified.

- To formulate a framework or conceptualise the process of managing fire hazards from a public policy perspective.
- To provide guidance based on the constructed framework for policy makers in the Kingdom of Saudi Arabia.

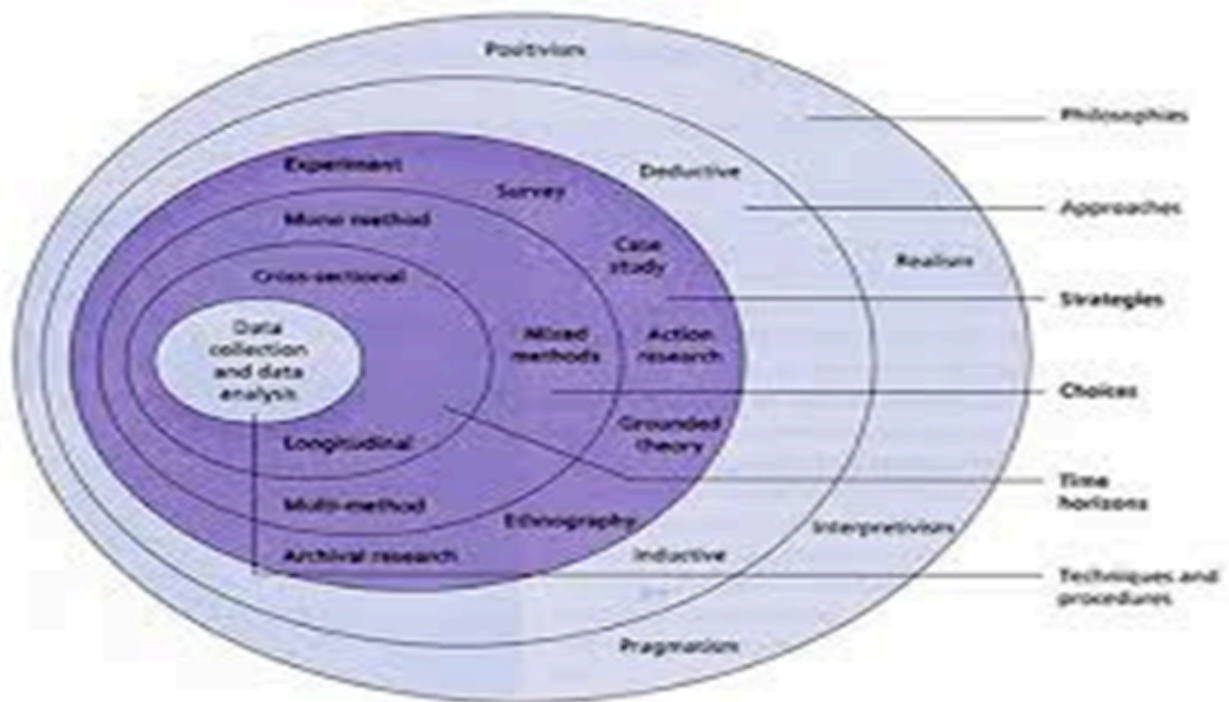
Each aspect listed above is intended to draw attention to and explain the different parameters and aspects involved towards the developing of an effective strategy to deal with fire hazards in the Kingdom of Saudi Arabia. The study takes certain practical measures and involves an inductive based approach to enable understanding and identification of core concepts.

The research design for a study may be described as a detailed operational plan which defines in advance the various tools and operations which are needed, in order that the substantive study may be successfully accomplished. It ensures furthermore that the collected data is able to answer the research question inherent in the study (McNiff & Whitehead, 2002).

Data collected, will, inevitably, fall into the categories of primary and secondary, and it is important that the research design is able to differentiate between the two in order that both method and analytical tools may be suited to the task.

Saunders et al. (2007) proposed a multi-level procedural structure, a multi-layered model resembling an onion as depicted in Figure 3.1 below. Following the structural procedure of this model it is deemed necessary to complete each level before moving upon the next, the fundamental sequence from the exterior of the problem, working in toward the core, being Philosophies, Approaches, Strategies,

Choices and, finally, Time Horizon. Figure 3.1 The Multi-layered Research “Onion” Model. (Saunders et al, 2007).



3.3.1 Research Paradigm

Research philosophies are many and varied, incorporating such diverse approaches to the subject as hermeneutics, realism, relativism, subjectivism, de-constructivism, constructivism, interpretivism, positivism and post positivism. When undertaking such research, the researcher needs to consider different research paradigms, as well as ontology and epistemology, since these describe assumptions, perceptions, beliefs, and both the nature of and knowledge of reality and truth that is assumed by the researcher about the phenomenon under investigation (Saunders et al., 2007). They are therefore able to influence the research design, the method and finally the conclusions. It is therefore important that the correct research philosophy to underpin the research is selected (Mertens & McLaughlin, 2004).

Positivism and interpretivism are mutually opposed, the former seeking to understand human behaviour through examination of the institutions already existent in society, while the latter examines the individual himself in society. It could therefore be said that positivism is a form of macro-sociology, whilst interpretivism is a micro-sociological approach: positivism seeking to treat sociology as a science – countable, analysable, subject to repeated verifiable experiment, quantifiable – while interpretivists consider that human behaviour cannot be interpreted via any means of quantification.

Positivism would therefore claim to be predictive (Saunders et al. 1998), which is not a quality demanded of interpretivism. Hence positivism is favoured by quantitative analysts, whilst interpretivism finds its place in the more flexible qualitative analysis. The differences between them are summarised in the following table:

Realism, however, subscribes to a different philosophy, contending that despite human opinion and intervention, there is a firm objective and knowable reality, and this can only be enriched by building theory, and thence expanding knowledge, (Creswell, 2004). The perception of the existence of a problem requires the initiation of a research program to understand and resolve the issue. And, to undertake a research there is always the requirement for a proper methodology to execute the process (Creswell, 2007). Such an outlook would be useful towards formulating an appropriate research methodology for conducting the exercise, ensuring that an appropriate flow and relationship is maintained on how the research is designed, how it is practically conducted and finally how the results are summarized and tabulated.

Understanding and perceiving the boundaries of the research and its processes is a prerequisite for the successful implementation of the initiative, without which all efforts expended would probably come to waste (Guba and Lincoln, 1994). Therefore, Kuhn (1970) has stated the research paradigms as being a summary of the generalizations, the beliefs and the values involved which explains the methodology adopted by the researcher. Hence, the research paradigm could also be summarized as being the sum of the varied ontological, epistemological and methodological assumptions (Collis and Hussey, 2003, p. 34). Setting the paradigms of the research is very important since this in turn enables the researcher to set the boundaries for conducting the entire exercise, since this would also enable the researcher to have a clearer understanding on the topic being considered (Guba and Lincoln, 1994).

Malhotra and Briks (2003) are of the perspective that research paradigms comprises of certain aspects already known, certain assumptions made, certain challenges identified, and relating all of them together (ibid, p. 136). Hence, a well thought out research paradigm significantly supports the entire initiative by facilitating the study to be conducted in a more efficient and well thought out way, contributing to better results towards resolving the issues on hand (Sarantakos, 2005). Guba and Lincoln (1994) additionally explain that the research paradigm could be further made clearer by directing attention to the assumptions related to ontological, epistemological and methodological aspects.

The aspects are so aligned so that answering one would in turn lead to understanding the nature of the next aspect. Hence, Guba and Lincoln (1994) are also of the view that these assumptions are made by the researchers themselves

and are, therefore, perhaps not entirely reliable. Considering this, it can therefore be concluded that no methodology employed to undertake a research project could be the one single ideal methodology.

Considering just how few research initiatives have been actually undertaken towards attempting to understand the fire hazard management process, an inductive approach appears logical. Considering that inductive enquiry methodologies often provide for a more thorough understanding of new concepts, a new thought process was required to be able to gain new perspectives on the issue. Hence, the individual philosophical aspects which provide the foundation for the research paradigm are explained.

3.3.2 Ontology

The ontological assumption is more related to the clarity of the researcher regarding the issue at hand, and is therefore more concerned with the researcher's perception of the reality of the situation (Morgan and Burrell 1994). Hence, the perceptions related to this aspect can be either an objective perspective, or alternately a corresponding subjective perspective on the extremes. Objective positions therefore regard reality for what it is and the corresponding ontological hypothesis is of the perspective that society is fundamentally a mathematical universe wherein all aspects are related in numerology which in turn makes for the ability to understand all aspects quantitatively (Kvale 1996, p.67). On the other hand, subjective based reality is based on the premise that there are multiple versions of reality, with each version being visible to individual visions and dependent on the context of the subject and the research process adopted. The theory is held since subjective ontology is of the assumption that individual researchers can immerse

themselves within their own paradigms of reality based on how they perceive the situation (Goodall 2000, Proctor 2003, Ettinger and Maitland-Gholson 1994). Buhl and Mick (1992, p.318) are of the perception that every individual is unique and has their own perception on how they understand the world.

The subjectivist ontological aspect is deemed to be of even greater significance if the phenomenon under consideration and being researched is such that it has not been the focus of deeper study previously (Lincoln and Guba, 2004). As a general rule, socio-econometric studies such as previous studies mapping risk factors of fire hazards, are dependent on subjective reality considering that they set limitations and boundaries on the reality under observation to the naked eye. Hence, Lucas and Prescott (1983) are of the opinion that this could be a weakness of socio-econometric analysis since the process allows for the application of limitations on social events, which probably hinders the development and evolving of natural phenomena and events. Such limitations are also a stumbling block and a barrier to integrating policy changes into socio-economic policy which is but a natural process. The quantitative statistical aggregation based studies of the socio-econometric model and process are, therefore, something which does not actually contribute to facilitate the entire process which is perhaps why such models are not favoured by some researchers. Such deficiencies are also of greater significance when the study is about a topic which has probably received scant attention and focus in previous studies in an environment like in Saudi Arabia (Zahra, 2011, Luciana, 2013). This has been supported by Nobel laureate Coarse (1981) who is of the rightful opinion that should you exert enough psychological and physical pressure on any individual to a certain extent, it is very much possible to extract any confession desired (ibid, p. 27).

3.3.3 Epistemology

Epistemological assumptions which are derived from objective ontological approaches, by nature, have and bear a positive character since the theories in this case bear resemblance to reality and the researcher is constrained to work within the limitations set forth by the theories (Taylor and Bogdan 1984), something which is but a standard feature for socio-econometric studies and theories (Summers, 1991). On a corresponding note, it is essential to have some level of understanding related to the subject matter in order to be able to construct a functional hypothesis which would also be within the limitations set forth by the constructs and parameters observed (Creswell, 2007). Hence, examining theories on the basis of a functional hypothesis would, therefore, be involved with either supporting or disproving the theories and conclusions arrived at (Bryman and Bell, 2003). Such modes and processes of study are more related to the ability to test and evaluate the knowledge levels of the researcher evaluating the subject matter under consideration (Mick 1986). Hence, objective ontology is a very important underlying factor in the background of positivist epistemology and it is important that any bias against this is resolved at the earliest possible point.

Creswell (2007) is of the perspective that understanding the why and the how is definitely facilitated by employing concepts of inductive logic while quantitative strategies and modes are perhaps more appropriated for having an insight into the dynamics of the relationships corresponding to the 'what'. Hence, the basic concern is arranging to compile the expertise of the researcher towards ultimately deriving meaningful conclusions (Summers, 1991).

As a general rule, interpretive research is intended to form the basis for enabling a thorough and complete understanding of the particular aspect under study to enable a complete understanding of the subject matter under consideration (Trochim and Donnelly 2007). Taylor and Boglam (1984, p. 2) are of the opinion that the researchers themselves need to have a thorough perspective of the issue under consideration to be able to recommend solutions derived from the study (Taylor and Bogdam 1984, p. 2) which is why the concept recommends formulating hypothesis from the cold hard facts rather than from theory. For the researcher, this is something positive and facilitates them since they are limited in the scope of the knowledge base and pool they can access in deriving and drawing upon their hypothesis (Glaser and Strauss, 1968). Hence Glaser and Strauss's (1968) Grounded Theory approach is a fundamental approach employed in this document to have a perspective on the epistemological position related to this study.

3.4.1 Research Strategy

Research strategy is "the general plan about answering the research question(s)" (Saunders et al., 2000). Morgan (1988) believes the nature of the problem affects whether the research is going to be exploratory, descriptive or casual. Yin (2007) confirms that the right research strategy can be determined by considering three conditions. These conditions are the type of research question posed, the extent of control an investigator has over behavioural events, and the degree of focus on contemporary events as opposed to historical events.

The research strategy that will be used to gather empirical data will be a survey and in-depth interviews. A survey is defined by Saunders et al. (2007) as 'the structured collection of data from a sizeable population... using techniques such as

questionnaires, structured observation and structured interviews'. Need better definition – Look at Morgan (1988). The freedom to use different techniques in the survey gives a flexibility which is advantageous to the study.

3.4.2 The Qualitative-Quantitative divide

There are two common methodological approaches in social sciences: qualitative and quantitative (Creswell, 2003; Saunders et al., 2003). Qualitative research is based on intensive study of as many features as possible of a small number of phenomena. It seeks to build understanding by depth. Often, its methods are associated with the phenomenological position (Morgan, 1988). On the other hand, quantitative research is based on the numerical measurement of specific aspects of phenomena. It is a very structured approach and its main aim is to generalise (Creswell, 2003). Its methods are often associated with the positivistic position (Patton, 2002).

The qualitative approach is often small-scale, and aims to obtain a richness of detail rather than statistical generalisations. It also aims for detailed description and understanding of the phenomenon under investigation by way of observation and involvement (Murnane & Willett, 2011). Furthermore, qualitative research is a method that involves collecting, analysing, and interpreting data by observing what people do and say (Creswell, 2003). In fact, qualitative research focuses on understanding phenomena and describing both the meaning and implications of events (Saunders, 2004). A qualitative approach also works as a useful planning tool for a subsequent quantitative approach. Murnane and Willett (2011) argue that criticisms of subjectivity, flexibility, lack of rigorous experimental control and

determinism are often levelled at qualitative data collection and analysis. These characteristics result in limiting their application to certain types of research.

On the other hand, the quantitative approach places considerable emphasis on statistical generalisation of findings that seek to explain and predict events in the social world by searching for regularities and causal relationships between constituent variables (Murnane, 2004). The collected material is coded and analysed objectively and is considered to be more reliable (Saunders, 2009). Furthermore, the quantitative approach is also a cheaper alternative compared to the qualitative. Moreover, quantitative research is concerned with discovering a causal relationship, prediction or explanation of a relationship comparing or relating several variables under investigation (Creswell, 2003). However, a major weakness with this approach is that it is not possible to go into depth in every area at the same time since it is standardised and therefore does not give any room for interpretations and new angles (Trochim, 2006).

It is clear that there are differences between the qualitative and quantitative approaches. Nevertheless, Tabachnick and Fidell (2007) argue that because research into strategic issues requires the collection of complex evidence concerning “how”, “why”, and “what”, the two approaches can be often be used in conjunction with one another as complementary approaches. According to Trochim (2007), the inclusion of case studies from different time periods enables the analysis of patterns of complex phenomena over time in order to detect, for example, possible organisational learning .

According to Tashakkori and Teddlie (1998), quantitative panel is frequently used when measuring change over time whether in attitudes, behaviours and when

looking at causal links, they added the true longitudinal qualitative approach, which has been used extensively in different research fields. Social science can be conducted within a quantitative or qualitative context (Saunders, 2005). These approaches have been covered by other terms like deduction and induction, or empirical and theoretical (Tashakkori & Teddlie, 1998). Quantitative research can be constructed as a research strategy that emphasises quantification in the collection and analysis of data and that entails a deductive approach to the relationship between theory and research, in which the accent is placed on the testing of theories.

By contrast, qualitative research can be constructed as a research strategy that usually emphasises words rather than quantification in the collection and analysis of data and that predominantly emphasises an inductive approach to the relationship between theory and research, in which the emphasis is placed on the generation of theories (Creswell, 2012). The basic purpose of a qualitative study is summarized to be an attempt to break down the different aspects of the topic with the intention to clearly explain each of the aspects in clear detail (McCracken, 1988, p16). On a corresponding note, Bryman et al. (1999) is of the view that the qualitative approach attempts to explain issues from the viewpoints of the very people making the enquiries (ibid. 75). Hence, qualitative research models are often of significant assistance towards drawing the relationship between inductive and subjective epistemology and ontology respectively. On the other hand, quantitative approaches help to explain and clarify the positivist epistemology and objective ontology.

Considering that this study makes significant utilization of inductive and corresponding qualitative logic, the former is basically abandoned. The qualitative research methodology goes on to explain and provide detailed answers to multiple questions and queries (Geertz 1993) which is certainly welcomed by researchers (Davies and Chun, 2002). Considering that there are hardly any studies undertaken regarding mapping the management process needed to alleviate fire risk at a national policy level generally and within the Saudi context, a qualitative approach would therefore be most recommended. Hence, it can be hoped that adopting a qualitative approach would shed significant light on the topic, explain the multiple aspects and issues which require to be explained (Covaleski and Dirsmith ,1990) since it provides detailed information (Ambert et al., 1995) without the requirement to undertake a separate definitive study (Maxwell, 2005). This would facilitate the researcher to concentrate more on specific issues which require his attention, while excluding and filtering out the remaining factors (Gephardt, 2004).

Quantitative research places heavy emphasis on using formalized standard questions and predetermined response options in questionnaires or surveys administered to large numbers of respondents. Alternatively, qualitative research tends to focus on the collection of detailed amounts of primary data from relatively small samples of subjects by asking questions or observing behaviour (Stake, 1995).

Quantitative research uses numerical data, and typically, structured and predetermined research questions, conceptual frameworks and designs. Alternatively, qualitative research not only uses non-numerical and unstructured data, but also, typically, has research questions and methods which are more

general at the start, and become more focused as the study progresses (Patton, 2005).

The quantitative approach places considerable emphasis on statistical generalisation of findings. In contrast, qualitative methods aim to elicit a richness of detail rather than statistical generalisations. They also aim for detailed description and understanding of the phenomenon under investigation by way of observation and involvement (Trochim, 2003). Patton (2005) points out that the major characteristics of qualitative research is that it is naturalistic, preferring it to study people, things and events in their natural settings. However, qualitative research is often criticised for lacking generalisability, being too reliant on the subjective interpretations of researchers and being incapable of replication by subsequent researchers (Stake, 1995).

Qualitative research also fits within the construct of the fire service (Altay & Green, 2006) best described this form of research:

The word qualitative implies an emphasis on the qualities of entities and on processes and meanings that are not experimentally examined or measured. ... qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry. Such researchers emphasise the value laden nature of inquiry. They seek answers to questions that stress how social experience is created and given meaning (p. 8). The use of a qualitative, participative approach allows for the engagement of key stakeholders. A qualitative approach also allows for full exploration of issues in order to capture their depth and to assist in understanding their complexity and the context in which they exist. In accordance

with the concept of understanding the researcher's view, too, sought to "understand action in terms of meaning" (Patton 1997, p. 18).

Both types of research (qualitative and quantitative) equally legitimate. Hence, when we are talking about the choice of methodology, the question is not about its quality but about its suitability (Saunders, 2005). Given the research question(s) under study, a suitable methodology should be selected. Some research questions require certain types of strategies and do not leave much room for flexibility (Altay & Green, 2006).

3.5 GROUNDED THEORY

Glaser and Strauss's (1968) theory proposed towards inductive query is named the Grounded Theory which propagates that the knowledge base in any research initiative undertaken should be based on a solid understanding of the issues and challenges related to the topic under consideration (Strauss and Corbin, 1994). Hence the theory is a practical approach to understanding the parameters to be considered in formulating a research initiative. Generally, research is involved with analysing the situation and on a corresponding note tabulating the derived results towards arriving at a meaningful conclusion. As per Strauss and Corbin, (1994), an important of the analytic methodology is also related to the comparative analysis process employed (ibid. p. 272).

As Glaser (1978, p. 3) has already noted and explained in the course of his studies, the process of executing the research process and simultaneously gathering the relevant data are basically very closely interlinked. Hence, perhaps a primary benefit accrued from the Grounded Theory is its emphasis on forming a sound

theory before proceeding with the actual research activity. As Strauss and Corbin (1994, p. 273) have expounded, the theory can be customized to fit any research activity and process being initiated and is, therefore, flexible (Strauss and Corbin, 1994, p. 273).

A reason for the ready and wide acceptance of the Grounded Theory method (GTM) among social scientists of all shades is perhaps because of its flexibility in accommodating the multiple requirements of researchers in their efforts to complete their studies and derive results. As per Glaser and Strauss (1967),

“Irrespective of the requirements and format of the research, all data accumulated in the course of the research is accorded a certain level of importance in that it can offer some input on the subject matter. The basic aspect is how the data is being considered and observed, besides of course the skill and expertise of the researcher. Hence, all data is utilized” (ibid, p. 13).

To allow for a proposition to take shape, having a concept in mind is perhaps a prerequisite (Blumer, 1969). Hence any and all propositions require the writer, the author, and the researcher to be well conversant with the subject under consideration (Glaser and Strauss, 1967, p. 32). Considering this, both the natural science form of prepositional presentation and the discursive proposition presentation both require equal levels of input and effort from the part of the team drafting the same (Strauss and Corbin, 1994, p 278).

While explicit data presented is certainly a source of information in the report compiled, implicit information is also conveyed by the tone, the mannerisms and the

language of the document (Flick, 1998). As per Goulding (1999), the distinctive attitude and expertise of the researcher certainly has a significant bearing on the ultimate format of the report extracted after all the input and effort, considering that at all times it certainly holds true that an analyst is certainly affected by the effort put into the formation of the report. Goodall (2000) is of the recommendation that the inclinations and mind-set of the analyst and the researcher is best understood before deputing the individual to conduct the survey and the research so that personal likes and dislikes of the individual does not shade the outcome concluded from all the effort expended.

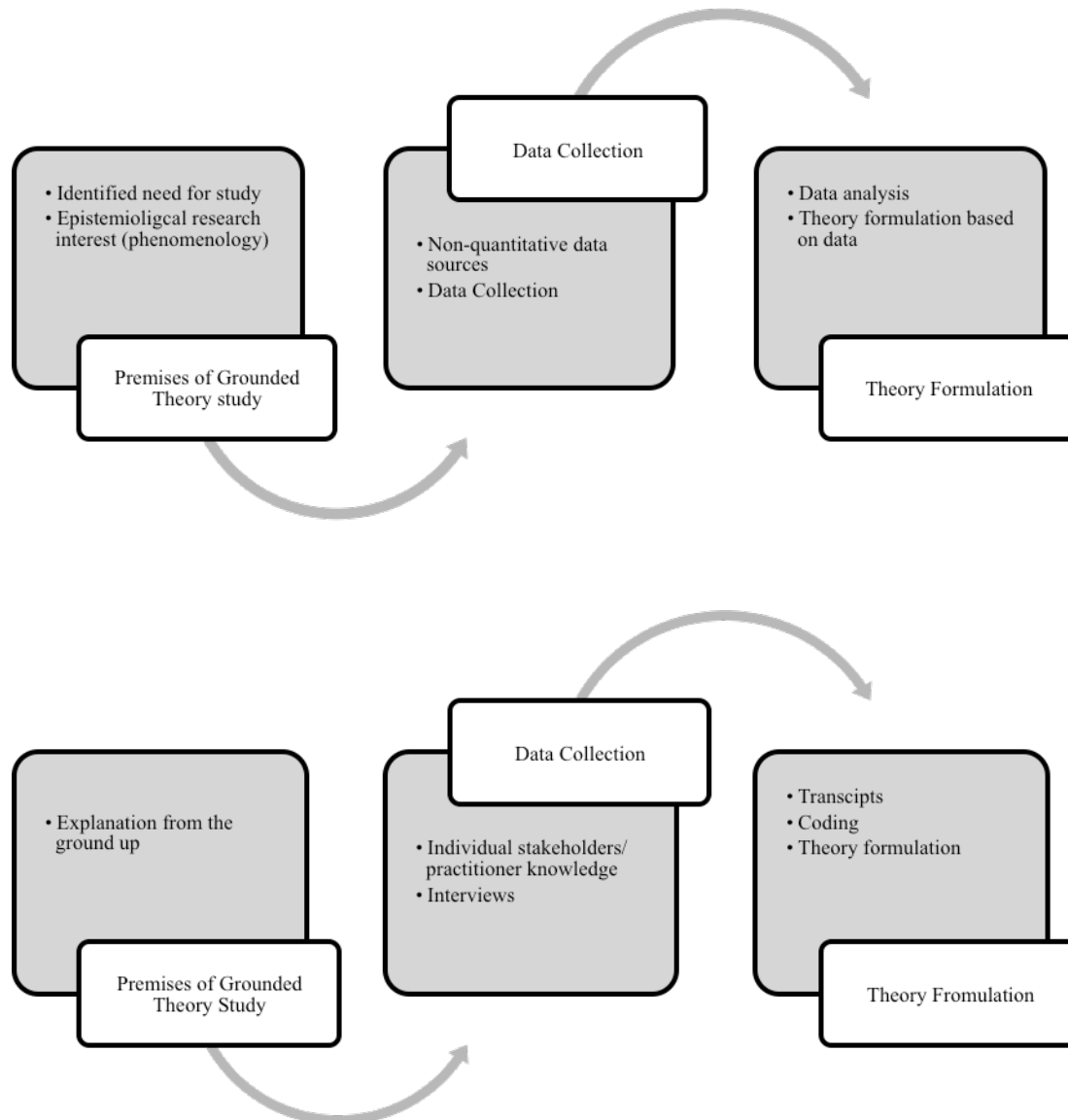
An important aspect which needs to be considered is that of the reflexes of the analyst in the course of deciding on the individual to be associated with drawing up the conclusions of the report (Goodall, 2000). As per May (1998), the reflexivity characteristic of the individual goes on to determine the ability of the individual to detect the minor nuances and the small aspects which may as well have significant and major impacts on the conclusions derived if inadvertently left out or if they pass undetected. To supplement the above, Cromby and Nightingale (1999) are of the perspective that:

“It is important that the researcher is able to contribute meaningfully to the entire exercise, and to conclude the same exhibits a good measure and understanding of the level of relation required to complete the assigned task. The reflexivity aspect of the researcher demonstrates the analyst’s ability to comprehend the requirements regarding the deliverables associated with the initiative” (ibid. p. 45).

Considering the above, the past experiences of the researcher and the social background of the analyst are bound to have an effect on the quality of the work

produced and delivered by the researcher (Butler-Kisber 2010). Further, it has also to be ensured that the initiation of the research process is made with the beginning taking place under optimum conditions to the furthest extent possible since this in turn would significantly affect the conclusions derived from the exercise. Considering this, it would be rightly concluded that social studies cannot be conducted in isolation, away from the effects of corresponding factors which in relation to other aspects is bound to colour the conclusions to be derived (Hammersley 1997, p. 16).

Figure 3.2 Methodological Approach



3.6 RESEARCH METHODS

The primary research undertaken in this regard is a series of twelve investigative interviews with the executive management of the Fire Safety

department of the Civil Disaster Management division of Saudi Arabia, with the format of the interview conducted and the reasons for the questions so asked explained in later sections.

3.6.1 In-Depth Interviews

In-depth interviews provide for detailed answers (Bell 1993; Gillham 2005; Warren and Karner 2005). While there are multiple interview formats, including structured, unstructured and semi-structured, but deciding on the proper methodology would vary from situation to situation depending on the objectives of the exercise (Foddy 2001; Ressler 2009).

Gillham (2005) is of the perspective that the semi-structured interview is a very convenient methodology towards deducing results from an interview session, considering the level of flexibility offered by the methodology (ibid. p. 70), since the process allows for descriptive images to emerge from the sessions. Individual interview sessions of this format allow for the interviewer and the interviewee to develop a rapport between each other (Thompson, 1998; Guba and Lincoln, 2004). On a corresponding note, open ended interviews tend to leave too much at the discretion of the interviewee, while structured sessions hardly allow for any flexibility in the questionnaire processes. Therefore, semi-structured interviews could be indeed considered to be the middle ground amongst the three formats discussed (Thompson, 1998). However, considering the above and the aforementioned, there is also the perception that a certain level of reflection should be allowed to the interviewer so that he can digest the answers provided and thereafter decide on the next question to have a complete picture and understanding of the situation (Zikmund, 2003).

Ressler (2009) further explains that semi-structured interview sessions are ideal formats towards judging situations and associated parameters in their entirety. Hence, as explained by Rubin and Rubin (1995), there are basically three measures of grading and judging the category of the interview, which include:

- Whether the interview is basically more of a discussion between the interviewer and the interviewee.
- Whether the session is directed towards offering support to the interviewee and is supportive and condescending of the latter.
- The extent to which the format of the questions enquired upon is customized as per the situational parameters of the interviewee.

Hence, in-depth interviews could also be judged to be on the lines of social events (Holstein and Gubrium, 2003) considering the freedom and flexibility of the format and the ease with which interviewees are expected to answer the same (Rubin et al., 1995; Schutt, 2004). In such formats, perhaps the only reason the interviewee could perhaps try influencing the course of the session and the answers, would be if the conversation seems to be steering away from the basic parameters of the topic on hand (Holstein and Gubrium, 2003, p. 179). Correspondingly, Schutt (2004) is of the recommendation that where the interviewer is compelled to forcefully steer the course of the interview, this should not necessarily be done explicitly but can rather be done and performed in an implied manner. Where the quality of the answers being provided is observed to be personal and descriptive, a series of interrelated questions in succession could be utilized to ensure that the flow and the momentum of the information delivered is maintained (Gillham, 2005; Holstein and Gubrium, 2003; McCracken, 1988; Rubin and Rubin, 1995). Hence, it could be

concluded that the primary and basic aim of an interview session would be to compile the maximum amount of information from the interviewee, while simultaneously ensuring that the interviewer's personal bias is not allowed to cloud or shade the quality of information gathered during the process (Schutt, 2004).

As per Gillham (2005), a semi-structured interview calls for a series of probing questions to be asked in order to help understand the topic more clearly (ibid. p24). Hence, a series of opening questions on the interviewer's part assists towards understanding the general direction of the session, while subsequently the sessions are more investigative in nature. This then follows for a seasoned interviewer to discern on how to extract information from the interviewee, deciding very early into the interview on how the questions are to be strategically placed for the maximum information output (Gillham 2005).

Hence, it is upon the interviewer's skill and expertise to be able to coax out the maximum information from the interviewee (McCracken 1988). Definitely, the interviewer has to be fully immersed to the task at hand, filter out all other distractions and pay his undivided attention to the on-going session to discern on the key breaks observed in the interviewee's answers so that a series of probes could be strategically placed to summarize the maximum output from the session (Ressler 2009). To summarize the above, Creswell (2007, p. 133) is of the perspective that a good listener can be a good interviewer.

A detailed semi-structured interview session is in harmony to the related ontology and epistemology. Hence, the use of a mix of probing questions of varying degrees would be quite effective in having in-depth information and detailed explanations from the sample. A semi-structured format of the interview, perhaps

vaguely listing the various primary topics to be discussed would be a good way for the preparation of both the interviewer and the interviewee for the session, reading a little on the background of the topic(s). This is a reason numerous researchers have favoured the semi-structured interview format in conducting such sessions with the industry informants (e.g. Wengraf, 2001). Saturation point was reached after twelve interviews with senior members of the Civil defence team, each with experience in fire hazard management.

3.6.2 Focus Group Interview

A focus group interview session was also conducted with a view to formulating a strategy as per the fire-risk reduction process. The basic premise for conducting this was to ensure that there were multiple formats for the testing and analysis of the data obtained so that the authenticity of the same could be ensured. Hence, as per Kamberelis and Dimitriadis (2005), focus group methodologies have also allowed social scientists to effectively gather useful information corresponding and applicable to various scenarios (p. 902). Individual one-on-one interview sessions allow for close and meaningful interaction between both the interviewer and the interviewee (Kamberelis & Dimitriadis, 2005, p. 902). Hence, focus groups are important sources of information in instances where individuals, by themselves would perhaps not consider the event to be of much worth, but when in a group they may then collectively realise the importance of the same and then accordingly explain it (Kamberelis & Dimitriadis, 2005, p. 903). Hence, it could be rightly understood that focus groups allow for gathering information which would have not been otherwise possible to be found from individuals as a single entity (Kamberelis &

Dimitriadis, 2005, p. 903). This research exercise, therefore, invited Saudi Ministry of Civil Defence staff for focus interview sessions.

Conversations and interviews conducted with the focus group were recorded, with printed transcripts of the same being analysed at a more convenient time. A Civil Defence team was specifically selected considering their exposure to working under pressure and stressful situations, and a group of individuals were ideally requested who had expertise counselling people in various aspects of fire based relief and disaster management. Consequently, a 16 member team from the Saudi Ministry of Civil Defence were assigned for the exercise. The corresponding feedback obtained from this group is detailed in a subsequent chapter. Discussions with the focus group enabled the construction of a formal framework, which included rephrasing and rewording questions and the related in the official document. Based on the feedback from the four five member groups, and the corresponding valued input, a few minor corrections were formally incorporated into the framework before rolling out the final version for circulation in the Saudi Civil Defence Ministry, but unfortunately no replies were forthcoming from the relevant recipients this time round.

The focus group selected for this exercise was based on the interpretive paradigm of the 'truth value' aspect, which was judged against the credibility of the group. As per Lincoln and Guba (1985), credibility of an individual and a group is judged on the basis of multiple factors and aspects, including the likes of length of engagement of the individual/ group, observation, conducting background checks, ensuring that investigators engaged are trustworthy, peer debriefing, negative case analysis, referential adequacy, member checks and a host of other and related

factors and methodologies which will be debated upon in the ensuing text. The credibility was most emphatically observed in the aspects of peer debriefing, negative case analysis and referential adequacy which are discussed herewith:

Peer Debriefing: The focus group analysis was conducted by a facilitator and a note-taker who debriefed the focus group. On the conclusion of each session, the two man team recorded their comments in 10 minute recordings which included comments on the emerging trends observed. Transcripts of the recordings were later circulated towards analysing the relevant information that could be accrued from the recordings.

Referential Adequacy: This is related to making the source data accessible to the investigator and the researcher. Considering that the data available was taped and later transcribed, this was gone through repeatedly. Meanwhile, the available data was not circulated and made readily accessible to other researchers and analysts.

To summarize the observations made regarding this aspect, it was concluded that the credibility criteria parameters were satisfactorily fulfilled in discussing the relationship between the participants verses the investigator. A robust public access initiative was undertaken to build up a level of trust and understanding with the respondents who already had a level of understanding with the researcher since they were all colleagues and known amongst one another. Focus group discussions were all conducted in a respectful manner, keeping in mind that everyone was assured of and provided with equal opportunities to participate in the exercise.

3.7 SAMPLING FRAMEWORK

Once the data collection methodology was finalized, Schmidt and Hollensen (2006) recommend deciding upon the sampling methodology in the next step. Hence, Daymon and Holloway (2011) are of the perspective that it is important to decide what and the how to sample.

The upcoming issue is deciding on how to initiate the sampling process (Daymon and Holloway 2011), and how to execute the same (Gorman and Clayton 2005; Schmidt and Hollensen 2006). In this regard, Schmidt and Hollensen (2006) are of the opinion that this process can be executed by either the probability sampling process, or else the non-probability process. For the former, it is argued that individuals in the entire population are all given equal weightage and this factor is accordingly accommodated in the process (Schmidt and Hollensen 2006, p.159). The latter, meanwhile, involves elements of qualitative exploratory research and the results derived need not be necessarily indicative of equal weightage to each individual in the population (Alston and Bowles 2007). However, for the purposes of this study, it is argued that implementing probability sampling processes would not be ideally recommended, while the limitations inherent in non-probabilistic sampling too are kept in perspective (Alston and Bowles 2007; Schmidt and Hollensen 2006). Considering that the end target of this initiative is an analysis of the multiple variables of subjective interpretations and reality (Burrell and Morgan 1994; Creswell 2007) the non-probability methodology is more appropriate for this study.

Evaluating the current literature, it is argued and concluded that purposive sampling best suits the purposes of this initiative (Alston and Bowles, 2007; Daymon and Holloway, 2011; Gorman and Clayton, 2005; Sidin et al., 2008; Zikmund, 2003)

since the sample selection is done for a specific aim (Alston and Bowles, 2007; Zikmund, 2003) and researchers normally have groups already defined. In addition Zikmund (2003, p.380) is of the recommendation that the methodology's utilization of convenience sampling strategies are particularly aligned for exploratory research purposes, very much on the lines of the current initiative. However, Daymon and Holloway (2011) recommend that convenience sampling processes allow for the utilization of predetermined criteria. Besides, Zikmund (2003:382) is of the opinion that purposive sampling incorporates elements of the researcher's personal judgement in selecting the members for the sampling process.

On a related note, Gunter et al. (2002) are of the opinion that aspects of interpretive research and representative samples are not too important considering the primary objective of the initiative. Hence, generalizing the results being derived to the entire population is also unnecessary considering that each individual would have a unique perspective towards understanding the questions put forth to them.

Gorman and Clayton (2005) are of the recommendation that qualitative research initiatives normally consider purposive sampling processes since the objectives associated with such initiatives is more inclined towards exploring a specific event and factor (Daymon and Holloway 2011; Gorman and Clayton 2005). Therefore, the way the sampling population is selected in such initiatives is dependent on how much the population is determined to be mentally aligned and compatible to the purposes of the processes executed (Alston and Bowles; Sidin et al. 2008:8). Considering this, the purposive sampling process is utilized for this exercise considering that it is consistent to the interpretive nature of this study (Gunter et al., 2002).

Besides aspects of the sampling process finally decided upon, the size of the sample is of significance. Quantitative sampling exercises keep a check on the sample sizes in order to be in statistical alignment to the requirement of the multiple calculations (Bryman and Bell, 2003). Hence, quantitative studies would limit the size of the sample selected in order to efficiently provide the required results (Bryman and Bell, 2003; Kvale, 1996).

General theory is of the perception that indulging in the practice of collecting overly inclusive information and data leads to 'knowledge saturation', necessitating pauses in the process till the issue is resolved (Glaser and Strauss, 1967). As per Flick (1998), on reaching or exceeding 'theoretical saturation' levels requires the analyst to re-evaluate the information gathered and reset the process. As per Rubin and Rubin (1995, p.72), the researcher should ideally continue with the research so long as new input and information is continuing to be gained from the effort, otherwise reaching a stage when it is observed that despite all the effort expended if no new input is forthcoming, this would surely be an indication of having reached the data saturation stage. As per Krueger (1998) and Flick (1998), the researcher needs to be aware of this phenomenon, and should desist expending additional effort on reaching such a plateau (Flick, 1998; Krueger, 1998; Rubin and Rubin, 1995). For the purpose of this study, considering the professional identities of the senior professionals involved, it is imperative that the identities of the interviewees be redacted and this should definitely not be leaked out in any way.

3.8 INTERVIEW/FOCUS GROUP GUIDE DEVELOPMENT

Qualitative research studies are generally free flowing, with no specific format dictated (Creswell 2007). The basic parameter and design is presented here and the quality of information and data gained is reflective of the design of the process (Bloor et al., 2001; Stewart and Shamdasani, 1990). Often the interviewer has to repeatedly and continuously innovate and improve upon the format to ensure that the maximum outcome is gained from all the effort made (Creswell, 2007; Stewart and Shamdasani, 1990). The parameters and the depth of the interview need to be ideally pre-determined (Creswell 2007), and the research objectives need and require clarity to ensure success from the input made (Creswell 2007; Rubin and Rubin 1995). A series of questions could be designed, which could go towards resolving a particular 'super question', all of which would be ideally tested and walked through during the dry runs of the interview ideally conducted over mock participants (Gillham 2005). Correspondingly, open ended 'probes' also need to be planned out to ensure that complete information is obtained from the entire process.

The questioning process in an interview could perhaps begin with the initial questions being more generalized, and gradually as the session proceeds and the tempo of the process increases and picks up, the 'technical' questions could then be placed to the interviewee. This enables the candidates to feel comfortable in speaking their mind after a rapport is established with the interviewer (Stewart and Shamdasani, 1990). Correspondingly, Langford and McDonagh (2003) also support the aforementioned pace of the interview. Similarly, Warren and Karner (2005) too recommend that the opening questions should arrest the interest of the interviewee which could then be built upon in the subsequent questions in the course of the

session. Grounded Theory interview formats recommend that the key question should not be explicitly stated by the interviewer, but should instead be implied by other questions put forth to the interviewee (Glaser and Strauss, 1968; Strauss and Corbin, 2004).

The interview format designed for mass circulation amongst the participants was initially tested upon two colleagues to have a feedback on the level of responses which would be generated, as per recommendations by Gillham (2005). This exercise contributed to the deletion and reduction of a number of questions, ultimately bringing down the number to 6 primary enquiries after reducing it from the earlier 14. Corresponding probes were attached to the questions to expand on the answers so that complete information was obtained. Attention was also made on the grammar, the sentence structure and the punctuation of the questionnaire so that the entire format was error free to the greatest extent possible. The 6 questions and the corresponding probes are herewith presented:

Question One: This involved enquiring regarding the interviewee's experiences in managing fire hazards in Saudi Arabia. It was intended that this would provide the interviewee an opportunity to relax and broadly share his experience, while building a rapport with the interviewer. Key sub-questions aligned to this question included:

- The main aspects to be highlighted in managing fire hazards.
- The primary challenges in managing fire hazards.

Question Two: What kind of experience do you have in designing local, regional or national policy on more effectively tackling fire hazards or risk?

- Your perceptions of the challenges in leading such interventions?

- Your input on the barriers to effective interventions?

Question Three: Do you perceive that it is rational when people state that the Saudi government should do more to combat or design policy to tackle fire hazards?

- To what extent do you agree to this?
- What are the barriers inhibiting in following up with this advice?

Question Four: Available literature explaining fire hazards does not offer much on policy making interventions in Saudi Arabia on fire hazard management: why do you think this is?

- How do you perceive the Saudi government could do more to help develop more effective fire hazard policy?

Question Four: Could you kindly list some of the reasons you think are behind bad or ineffective management of fire hazard policy?

- Do you perceive that the Saudi Arabian government would bring meaningful reforms to develop education towards fire hazards?
- Do you perceive the Saudi Arabian authorities to be serious in combating fire risk?

Question Five: Could you list some of the challenges you feel fire fighters face in making their practice more effective?

- What kind of challenges do you feel the country has faced because of recent disasters?

- Are you aware of any specific instances where fire hazards were made worse due to bad practice? How?

Question Six: From your perspective, how do you think fire authorities could position themselves better in the public domain?

- In your valued opinion, what recommendations would you make towards enabling Saudi Arabia improve its record on fire safety management?

An advantage with qualitative interview formats is that they are so flexible in that questions can be modified to fit the situation even during an on-going session (Gillham, 2005). Hence, the auto-drive process allows for the interviewer subtly guiding the interviewee in a direction wherein the maximum possible quantum of information can be derived from the session conducted, which correspondingly allows for continuous improvements in the methodology and process of the interview being conducted. This degree of flexibility (Bloor et al., 2001; Stewart and Shamdasani, 1990) not only enables the analyst to reform and refine the interview process, but also correspondingly improve upon the research methodology adopted so that the output obtained from all the efforts made is justified (Warren and Karner, 2005).

3.9 DATA ANALYSIS

It is important that the analyst should be aware of what he wants to derive from his data (Warren and Karner, 2005, p 189). To this end, clarity on the objectives would be required, although at times the same could also change midway through the investigation on the receipt of previously unknown information. Hence, the ability

to continuously review information and data is required in an interviewer (Krueger, 1998). Glaser and Strauss (1967) advocated that the data revision process was a cyclic activity in aligning new input received and synchronizing it with existing information.

Thematic analysis would be basically involved with the comparison of information obtained from multiple sources in order to arrive at and conclude upon new theories and input, which when grouped together would provide a much larger theme (Butler-Kisber, 2010, p.47). It is also suggested that themes so obtained provide valuable explanations of the themes so covered which are entwined in the texts analysed (ibid, p 47). Hence, thematic analysis would be considered amongst the most intensive form of qualitative analysis towards analysing the multiple aspects of a study (Bird et al. 2009) and also to derive new conclusions from previously sorted information and data (Paskins et al., 2010).

Warren and Karner (2005) are of the opinion that before initiating a formal data analysis process, it is important that the researcher familiarize himself with the data by repeatedly going through it and reading it. Thereafter, the next process would be to probably categorize the same, sorting the available information into information which could provide new perceptions and an understanding on what is derived from it. Indeed, this can definitely be done either electronically or through manual processes (Strauss and Corbin, 2004). The trends and patterns observed during the analysis would all indicate towards important clues on what is happening in the situation under review.

Butler-Kisber (2010) is of the opinion that thematic analysis would normally provide either coarse grained or fine grained data information. In the context of he

grounded theory, the information classes defined would operate in relation to open-axial and the selective coding phases (Glaser and Strauss, 1967; Strauss and Corbin, 2004). The former entails the researcher to be thoroughly familiar with the raw data before being able to process the same to the degree and extent required by probably repeatedly reviewing the text presented, deriving and breaking down the information into multiple categories and thereafter assigning specific groupings to the categories so derived (Butler-Kisber, 2010, p. 30).

While taking notes during analysis, the data enables the analyst to track his or her thought process and therefore ensure that avenues once explored are not necessarily walked down repeatedly, the ultimate aim and objective of the initiative remains in that it is intended to generate new perspectives in analysing the data being reviewed. The fine grained analysis concept would require that the data being reviewed be processed through a finer observation mesh, so that even minute information and details do not escape notice by the analyst. It is to be also noted that putting down things in writing always goes towards ensuring that things are handled more systematically and in a proper procedure, so that the maximum possible benefit is squeezed from the available raw data and information (Butler-Kisber, 2010, p. 38).

Considering all the above, indeed the thematic analysis process is definitely indicative of being of significant assistance towards analysing data and information towards enabling the analyst to extract information and conclusions in a systematic and organized manner. The coarse grained approach allows for establishing broad parameters of theories associated with the study under consideration. To add to this, thematic analysis is a flexible mode of analysis and study (Noble et al., 2007) of the

outcomes from both cross-case and within-case review of interviews conducted. Eisenhardt (1989) does not recommend associating one interview with another during the analysis process except when evaluating common trends associated through all the sessions conducted. However, Corbin and Strauss (2004) recommend the opposite. Miles and Huberman (1994) are of the learned opinion that the cross case analysis enables the analyst towards determining the extent to which the themes observed in interviews conducted are typical or diverse.

Of the multiple approaches just mentioned, this document has adopted the Corbin and Strauss' (2004) approach and therefore cross case analysis formed an integral part of the entire post interview analysis phase. To grade and ensure that only relevant data was retained; responses were graded as being how relevant they were to the topic on hand. Hence, aspects of the analysis were deemed positive if they contributed towards understanding the effective management or otherwise of fire safety. A manual analysis methodology was favoured since this has proved to be more reliable towards explaining and establishing links in the kind of situations we are dealing with in this study (Ritchie and Lewis, 2003; Basit, 2003).

3.10 EVALUATING RESEARCH

Issues and challenges related to the reliability, validity and ethics of the qualitative research processes are looked into in the course of this section; considering these issues can create much controversy and be a source of diverse input depending on how they are being perceived (Silverman, 1993).

3.10.1 Validity

In layman's terms, validity could be indicated as ensuring that the data gathered and compiled through the entire exercise actually holds up to scrutiny, and bears coherence to the subject under discussion and evaluation. For the success of a research initiative, it is therefore very important that the conclusions derived are valid to the subject matter from a qualitative research perspective (see Lincoln and Guba 1985). In describing the conclusions derived, a narrative approach is often utilized so that the varied phases are starkly demonstrated, but this approach in turn adds burden to auditing the entire text so presented.

3.10.2 Reliability

Reliability normally refers to the aspect of whether the same results and conclusions currently derived would be again concluded if the entire initiative is once again started over from scratch (Hycner, 1985). Hence, while the use of standardized formats is not a problem, the non-standardized methodologies employed in the process are the source of primary concern in this regard (Robson, 1993). At stake in this regard is not exactly the methodology employed by the current researcher in coming to the conclusions presented in this document. Rather, perhaps what is of concern is whether the same results would still be concluded if a different methodology is adopted towards coming to the conclusions currently derived. (Baker et al., 1992) Hence, providing references to the various sections and key aspects of the research when presenting the conclusions goes to increase the reliability of the conclusions derived (Hycner, 1985).

Lincoln and Guba (1985) are of the perspective that credibility goes to provide stability to the conclusions derived, and reduces bias in the same. For the

purposes of this study, all the respondents who agreed to be interviewed were provided a summarized version on what the study entailed, so that the interviewee was mentally and emotionally prepared regarding the subject matter being analysed in the study and for which they were questioned. Further, if the interviewee had any reservations regarding any aspect of the entire process, he would have been encouraged to express the same so that the apprehensions could be satisfactorily resolved.

Lincoln and Guba (1985) urged the replacement of external validity processes with transferability, which encouraged that hypothesis were analysed and tested to the extent possible to ensure that they were indeed valid. So, the conclusions derived from the study, proving the corresponding hypotheses should be stable enough to the extent that should they be tested against another similar hypothesis; the conclusions should hold up to scrutiny in that case too. Hence, Wallendorf and Berlk (1989, p. 76) forwarded theories which encouraged that conclusions derived in proving a given hypothesis should ideally be strong enough to hold true are tested again against a similar hypothesis.

3.11 ETHICAL ISSUES

The University of Bradford dictated the code of ethics and guidelines for the execution of this study. At no time during the study was any coercion used against any respondent to either forcefully participate or answer questions they were reluctant to broach upon, hence respondents were all along given the option to decline at their will. The timings of the interviews conducted were ensured that they neither clashed with the respondents' official working hours nor too late in the night.

Since there was no coercion involved at any stage of the process, there was explicit and implied consent on the part of the respondent to all stages of the process interacted with them. Further, to ensure that the views and thoughts expressed by the respondents should not in any way affect the social and professional standing of the respondents who so kindly participated, the actual identities of the respondents were redacted in the final report and in the presentation of the findings and conclusions from the research initiative. Parameters and protocols of the 1988 Data Protection Act were also adhered to and respondents were at will to refuse answering any particular query they felt uncomfortable with.

3.12 SUMMARY

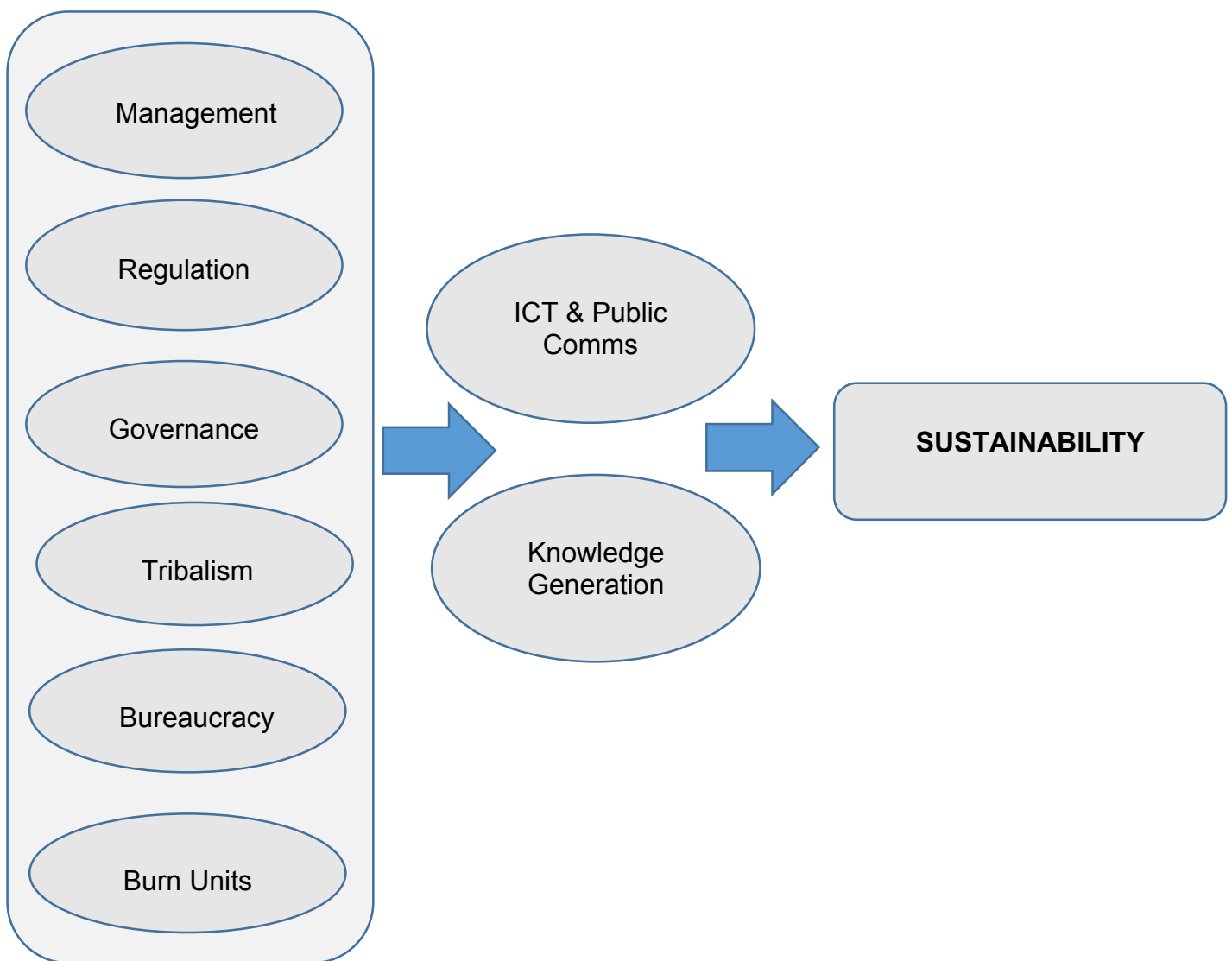
The philosophy behind the initiative undertaken for this research, and the procedures and processes adopted for this research are broached in this chapter. Two different interview processes, the semi-structured and focus group interview methodologies were both utilized for completing the data collection process in this study. Considering the validity of the conclusions derived, it could be said that the methodologies adopted were in sync with the requirements for this study. This could be stated with a fair level of confidence since the strategies adopted were all previously tried and tested. It was also ensured to the extent possible that the entire process was ensured to utilize an interpretive epistemological perspective and subjectivist ontological. The next chapter details the outcomes derived from the two phases of the study.

CHAPTER 4: RESULTS AND FINDINGS:

4.1 TOWARDS A FIRE RISK SUSTAINABILITY BASED FRAMEWORK.

This chapter summarises the key themes which emerged from the interviews and conceptualizes the themes into an overarching framework. Central to this framework is the concept of sustainability as the key outcome of any management process of fire safety by policy makers. This is since without a long term focus, it becomes a short sighted policy and therefore open to greater failure. Critical drivers of this sustainability approach are good management, regulation, governance practices especially accountability and transparency, reduction of tribalism, bureaucracy, and burn unit efficiency. However, given the modern environment of communications, information technology and communications, and in particular public education, are viewed as important mediators between the drivers and sustainability. The critical role of knowledge generation is also positioned as a mediator. In other words, without information technology and communications, and harnessing knowledge, the role and impact of the drivers is lessened. This framework is presented below as the main finding of this study and its core contribution, in figure 5.1. Clearly individual links between the drivers act on mediators as between mediators on overall sustainability but for summary purposes the model below is presented.

Figure 4.1. The Fire Risk Sustainability Based Framework.



4.2 SUSTAINABLE DEVELOPMENT AS OUTCOME.

This study proposes a sustainability based framework for disaster management given the overriding consensus amongst the sample that long term generation of planning and management was critical. Critically, early planning was deemed essential to pre-empt future problems. Currently however the sample felt that early planning was not done within the Saudi fire safety culture enough both from the public and from the service providers. The importance of sustainability was cited by most of the sample:

Jamal, a former trainer and now director at a regional level highlighted:

“...the problem we have is that we don’t plan for the long term. It’s a lot of short and medium term planning and initiatives but nothing planned for the twenty plus year period which to really tackle fire hazards is what you need. This sustainability approach is now becoming popular amongst some of our directors but nobody knows what it involves or what are its key drivers. We need more research like this which helps us to figure out what drives a long term mind set in our sector”

Abdul-Latif, a fire safety trainer for the past fifteen years, commented:

“How do we make our policy more long term? What will help us plan ahead for fire safety? These are the most important questions we need to solve. If you can help us understand what drives the development of this long term strategy then we can really help the people”.

Sustainability measures were largely divided into two types: structural which are based on building physical defence against fire hazards such as better building

structures and installation of fire alarms as well as non-structural investments such as regulation based issues.

Abdul-Hamid, a senior fire safety trainer explained this difference:

“Sustainability operates at two levels. First we need the sustainable materials such as better fire safer structures within the buildings. I think in the UK now it is illegal to build using low grade flammable building materials but here we do not have any such guidelines. And this leads onto the second issues for sustainability which is the actual regulations from the government which would help drive the structural sustainability. So you have this non-structural sustainability diving structural sustainability.”

The idea that sustainability for disaster management involves multiple perspectives, structural and non-structural, human and non-human elements, is echoed in the literature. Twigg (2004) for instance, argued that sustainability for disaster management should involve social, economic, psychological and environmental initiatives. Therefore, sustainable development can be understood as a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and situational change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable livelihoods are achieved when individuals and groups are able to maintain or even improve their social, political, economic and other opportunities in life without jeopardising opportunities for future generations and can resist sudden shocks or changes. The capability to cope with change and to create livelihood opportunities relates to people's health and happiness, their political freedom and social networks, their educational opportunities and also their relative

vulnerability to disasters. Social justice and equal rights to resources – regardless of gender, race, caste or ethnic identity – are preconditions for achieving sustainable livelihoods (Eade and Williams, 1995). This sentiment was echoed by most study respondents, with Abdul-Jalil exemplifying this sentiment well:

“Ultimately sustainability is a must for all society. We cannot have long term planning only for the palaces or big corporations like banks which always use expensive grade material because they can. They can afford fire systems like alarms and sprinklers. But what about the rest of society, some of our hospitals don’t even have water sprinklers or extinguishers. I think if you go to the UK you’ll know it’s against their laws not have these in public buildings.”

Since failure to commit to sustainable development practices intensifies fire disaster risk, the factors shaping the development outcome for a particular country need to be considered. In the preceding sections on management, knowledge, regulation, governance and ICT, quotes linking these drivers to sustainability have already been provided. Additional examples are added below to provide additional clarification of this relationship:

Abdul-Aziz, a regional level director, commented that:

“without good management in place we can’t possibly actualise an approach based on sustainability. Add to this the importance of embracing modern technologies, up to date knowledge and good practice”.

Osama, a manager with over fifteen years’ experience, explained that:

“long term solutions to fire hazards can only be achieved through having the right regulations in place and the best management systems. We need open and

transparent systems so we can all move forward together without some benefiting and not others”.

Abdul-Majid, commented that:

“for me we need to embrace many things but technology, good practice in management and an open system in which the best views are practiced and not only those from the same family name as the chief”.

4.3 DRIVERS

4.3.1 Management

A majority consensus to emerge from the focus groups and interviews was the need for more structured and professionalised management systems, procedures and policies. Most respondents felt that poor management from the supply side, i.e. from fire services contributed greatly to risk of fire disasters and given the cultural status quo in fire services policy progress in this management was slow. Indeed, this view echoes the literature since it is commonly established that public organisations and their cost efficiency are highly affected by the level of management. According to this research (e.g. Heinrich, 1999; Lynn and Heinrich, 2005), management is the directing, coordinating and controlling of activity which takes into account information, capital and human resources as part of an organisation that are harnessed and applied to achieve specific and achievable goals. Our respondents cited three separate strands of management logic relevant to fire safety risk reduction. These three strands - strategic, operational and administrative are summarised below:

The development and formulation of an organisational plan and bringing about an informed plan to realise this purpose is referred to as the strategic dimension. Our respondents felt that keeping this aspect in mind, it is essential for all fire service managers to thoroughly understand the concept, decide what the department needs to achieve and carry it out immediately as time progresses. As Abdul-Aziz, a chief station firefighter of over ten years' experience in management of fire stations, explained:

“With the help of these informed decisions, it would be possible for the community to gain the fire protection it deserves along with having knowledge of the resources of the department and capabilities of application.”

Determining the present performance of the organisation (Cohen, 1993; Cohen and Eimicke, 1995), establishing a consensus of goals and priorities (Schein, 1992), bringing about operational plans to meet the goals (Allison, 1983), achievement of goal monitoring (Lynn, 1997) and the remedial strategies devised and implemented (Lynn, 1997) are the key functions of strategic management. All of these issues were cited by our respondents as central in managing fire safety. Abdul-Majid, a senior management official in the central fire HQ of Jeddah for instance summarised this combination of factors:

“we need to develop a strategic approach to our management of our fire disasters and ask whether we know how well we are doing right now and where we would like to be, in terms of goals, objectives and performance measures. When I attended a fire safety and policy course in Chicago, the trainer there, a government advisor on managing disasters, the main lesson he told us get our strategic level management

right and the rest will flow, focus on performance and long term goals, and set up contingency measures and monitoring of performance”.

Administrative and operational level management was also mentioned by our sample. According to Peter Ducker (1974) operationalising the yield from resources is the actual administrative job description of any manager and therefore administrative duties define and shape the manager's ability to perform strategic management goals. Therefore the processes of sustaining, arranging and controlling the resources of the organisation refers to administrative management functions but actualising these to operational functions (Drucker, 1974). The obtaining and perseverance of these resources would be the key issue faced by the manager throughout the process. Hence, the key role of the administrator is to act as an intermediary between the environment and the resources of the organisation. He needs to efficiently exploit the resources present in the environment and protect the organisation from any external shocks, which may occur (O'Toole and Meier, 2000). Several respondents on probing further their references to strategic management referred to these levels of management. Abdul-Rahman, a senior trainer in fire safety for instance observed that:

“In order to conduct these activities, the manager needs to establish certain protocols that would help him apply all resources in a maintained, controlled, systemised and inventorial manner. The inter personal relationships being established must be done under a certain set of norms Human resources, capital, financial and information technology management systems are usually the administrative functions to be carried out which would help operationalise the procedures.”

Our sample noted the combinational value of harnessing these levels of management as reducing risk in decision making by fire safety officials at the local and regional levels. By having stringent and robust management practices firmly rooted in strategic, administrative and operational focus, fire safety management would be a better position to put the behaviour of individuals as a core focus in what they do. Indeed, this was considered an important outcome of effective management, i.e. better understanding of individual behaviour to reduce overall risk. Indeed, risk mismanagement was related to knowledge biases of senior policy makers. This phenomenon can be explained further.

The behaviours of individuals need to be understood before analysing and understanding the concept of disaster risk management. All respondents emphasised that not only individual public members must prepare for disasters beforehand but also managers of fire safety should have a long term focus in fire safety management. Poor strategic focus was directly responsible for the decision-making capabilities being “extremely poor” in some instances locally and at a regional level for “protecting the citizens of the community.”

One senior fire safety manager, with over twenty years’ experience, Abu Bilal highlighted the complexity of this relationship:

“It’s not easy to gather all the necessary information to make the right decisions beforehand, it depends on what time frame you are targeting in terms of contingency planning but a strong strategic focus is definitely needed to have this focus on information gathering. The more information the less the risk in decision making but there are many barriers to this information gathering. The problem is that poor managers will learn from short term feedback only, or ...how to describe this..... the

term in English...extrapolation is usually done directly from the present to the future and the past is not examined or dismissed completely. There is no long term vision for managers, no strategic focus.”

The literature on risk management for disasters also echoes this sentiment since it argues that the biases of managers may be reduced if the planners as well as the individuals are able to learn from the past, improve on the future through this learning and bring about policies, which would help promote better compliance with the code regulations (e.g. Meyer, 2010; Tierney, 2006)

4.3.2 Regulation

Fire regulations are formed to save lives and protect the property of individuals. The governments or public policy usually form regulations to enhance the quality of human safety. Public policy, in an economic sense, is the institution, which brings forward the rules of the game for the society operations. Institutions are those human implemented constraints, which structures the interactions amongst each other (North, 1992; 1993). Problems such as the externalities caused by urbanisation may arise and with the help of regulations it is possible to reduce the level of uncertainty in human exchange as well as the modern social issues (North, 1992). Critically, revelation was highlighted by almost of the respondents of this study. As Jamal Hamid, a fire safety training officer with over twenty years' experience, explains:

“Effective regulations are critical for managing fires in Saudi but it’s a complex issue. We just don’t have a strong enough sector wide body to regulate the rest of fire stations at local level. If we had this new development and if it had the power to endorse compliance things would improve at the local level. On the other hand

regulations targeting individuals or members of the public and companies. Like they have in the UK I think it's against the law or companies not to have fire alarms and even individual homes are protected by local fire safety officers putting in fire alarms to whoever wants it and if the local station does not they will cut their funding back. We are a long way from this type of revelation but desperately need it".

According to Rossi (2004), this issue of regulation efficiently fits into the institutional framework or paradigm. Rossi (2004) fire safety case study in places like Naples and Italy, found that institutional arrangements are affected by political power and "constituent power". These two powers are made up of the institutionalised civil society and urban social movements (Rossi, 2004: 156). For planning and regulations, institutions play a powerful role. Institutions formed for regulations are expected to be efficient with improved quality and safety which requires large amount of resource and regulation only requires a high level of effectiveness.).

A similar sentiment was expressed by several respondents. Abdul-Hamid for instance observed that:

"Effectiveness is extremely important when regulation is required to prevent structural fires. In the case of market failure, the public interest is to implement regulations, which would avoid this situation, and when government failure persists, private interests are pursued. Regulations are required to benefit the common man but there are several negative externalities from which the lawyers, politicians, bureaucrats and public enterprises take advantage of. "

Osama Ahmed, a senior policy advisor for disaster and civic engagement, commented that:

“this is an issue which goes all the way to the top of government circles. We cannot do anything without senior policy initiatives and regulations from the top. We don’t see much in this area because there is money to be lost by some senior decision makers”.

There are many issues which were discussed relevant to regulation. Some of these can be summarised. Respondents felt that if a significant number of the public can benefit from a situation, regulations are implemented so that suppliers and regulators are employed in a justified manner. This group could be an industry, rent seekers or regulatory captures. This significant group has the ability to bring the regulation to be applied and have an objective valuation. The privileges are much more than the time, vote or capital expenditure applied. Regulation is sold and offered if the public perception is that it will be beneficial. It aims to improve safety and quality and correct all kinds of market imperfections even though it may not benefit everyone. If the active regulation benefits a certain group, there is a possibility that the regulation would actually work. It is not possible to sufficiently justify that the regulation benefits majority of the residents. Interest group pressures and public policy must be examined. Regulation is usually supplied to benefit the bureaucrats or the politicians but they may be able to benefit the private sector or the constituencies. The scarce resources are applied to regulation implementation in order to help with market failure. This is the stated reason for justifying public expense. Quality of life and safety of the citizens is essential and the private or political interests are usually present in terms of gaining power, votes, money or status. The brokers are the planners in the process when usually the apparent beneficiary is the public interest.

Several respondents explained however that introducing regulations to protect the public from fire related hazards, either through individual or company compliance, could be an admission or seen to be an admission that the government had failed the public in not providing the regulation before. As Sajid Iqrama, explained:

“Regulations are ultimately introduced when something bad is happening in society which needs to be controlled so if all of a sudden in Saudi a law is introduced about fire alarms then the public will think why this was not done before, why the state failed us. We like the status quo in Saudi, even if it risks individuals fire related safety I’m afraid to say”.

According to the planning theory, regulation planning is present due to a reason and it is not specifically related to market failure of public interest benefit. Some respondents were reluctant to mention this point but admitted for instance that:

“Planners are also found to be selfish human beings who pursue their own interests. Even saints promoted self-interest through loving, giving sharing and other positive activities. However, being selfish does not mean they are corrupt. It means they require maximising utility in the best way possible, which is according to them.”

It would therefore seem that the help of a prudent interest group or industry, the planners must be given logical reasons to follow or promote a policy or specific course of action. This would be able to benefit the public as a whole but usually would only benefit that specific industry. The planners are well aware of this issue but would still follow what would benefit them the most and also entail public benefit. The question is if the community should regulate public interest. The question also

arises if the regulation would benefit the public at large or just the regulators and suppliers. Hence, the researcher is required to first understand the public interest objective. The fundamental question arises of whether regulations are able to reduce or prevent public fires and enhance public safety. The regulations must be able to achieve the public interest even though there is a high possibility of failure. Economic actors like planners and regulators conduct activities based on choices that would not be entirely for the benefit of the public (Tollison, 1988, 1991). Regulations, at all times, are not formed to be socially efficient but are to present formal rules which would be in the best interest of the ones with bargaining powers or those who are establishing new rules North (1992).

Also, at times it is observed that the regulation is expected to protect the rich or the poor, uneducated or educated or the technologically advanced or uninsured or insured. Public policy makers must keep all these individuals in mind as an additional aspect when forming and evaluating regulations.

4.3.3 Governance

Another critical theme to emerge from the interviews was the issue of governance. Many respondents expressed concerns that ultimately good governance practice is currently lacking but is needed before investments in management, ICT, education and crisis communications for instance could be further developed. Without the need for accountability and transparency, nothing else could move forward. Governance is therefore conceptualised as a critical driver of developing a long term or sustainable strategy for fire hazard management. In particular two key issues emerged, accountability and transparency.

Several respondents highlighted how it is only when policymakers and government officials can be made liable for their actions are they going to be receptive to their stakeholders, i.e. the public they serve. Furthermore, the accountability concept should be enforced on all those who are a part of the policymaking process, such as local governments, village elders, schools, universities, individual fire stations and regional headquarters as well as national bodies and the government.

Accountability refers to an agreement on well-defined responsibilities and duties of organisations and individuals and reporting of the actions taken based on which stakeholders might judge whether their views and requirements have been considered and if the standards of performance agreed upon have been conformed to. Accountability and transparency are interlinked concepts (Klitgaard, 1997; Turner and Hulme, 1997). There are two distinct directions in which accountability functions: downwards, i.e. towards constituencies or recipients (for example, through elections, and upwards (i.e. to donors or upper levels of government, for example, through performance appraisal). Downwards accountability is particularly crucial with respect to disaster risk mitigation. This is because it is imperative for one to recognize the actual issues and priorities of individuals afflicted with disaster so that their susceptibility can be decreased, meaning their increased involvement is required (Twigg, 2004).

As Mohammed Said noted:

“we are not in a position currently to hold to account individuals or local stations accountable for negligence, because of our culture of tribalism or ‘wasitha’ which interferes in all aspects of complaint handling in the Kingdom. If you belong to a

powerful family then your untouchable. And unfortunately most station chiefs if I'm allowed to say it are not there due to their own merit but due to their networks."

This problem but at the downstream level was also expressed with Abdullah Al-Latif explaining,

"we don't have a public accountability culture sonic somebody is not happy with the way their fire hazard was managed by us then the public currently has no pathway to complain about us. If they do, the courts will be on our side and it may take years to reach the courts and even then the complainant might face pressure to withdraw his claim, this is the way it is unfortunately in the Kingdom".

One way around this it as proposed by several respondents was to encourage the participation of stakeholders in designing policy making issues relevant to fire safety. It was argued that, in its most basic form, participation can occur through elections. However, there needs to be some form of decentralization so the needs of the local population are fully met, including less privileged groups. Decentralization is a kind of delegation where the power of decision-making is shifted from central to local governments. It should not be mixed with de-concentration that simply pertains to power distribution within central administrative bodies (i.e. from a ministry's headquarters to its district offices) (Crook and Manor, 1994). The participatory methods of fire safety management need to have direct involvement of those people who are most likely to face the impact of the disaster. This is important as it allows people to express the risks they are facing and the things that need to be done on a priority basis. This would ensure that problems are appropriately explained and suitable response methods are devised and executed.

Local knowledge and competency can be used to aid in carrying out an appropriate response to calamities.

The issue of transparency was noted as critical to helping create a climate whereby accountability and stakeholder participation could become a reality. As Yunus Sola noted,

“Transparency is needed so that policy-makers can be held responsible for their actions. People are encouraged to take part in collective movements when they have more information, which also aids in the dispersion of innovation. Transparency also plays an important role in avoiding corruption which, if not inhibited, might redirect valuable investments. Corruption is, most often, a product of insufficient accountability and participation. “

Qasim Atonya, a fire safety instructor added that:

“A key problem we have is the role played by our ‘wasitha’ cultural aspect, particularly in those municipalities where loyalty is essentially determined by affiliation and ethnicity. In such communities, officials may be pressurized to secure the welfare of their own group over others.”

Once accountability and transparency are in place then better coordination amongst various players of the fire risk management process is made possible when there is open flow of information, which also increases the awareness of the public regarding fire safety.

As Yasir Hammed summarised:

“This is why fire risk management practices need to include accountability and transparency since together they encourage freer information flow and therefore ultimately public education and awareness campaigns.”

4.3.4 Tribalism

One common theme running through the course of the research was the concern of the respondents on the level of corruption prevalent amongst the Saudi Arabian public sector employees. All in all, about 9 respondents highlighted corruption as a major impediment towards advancing any policy or management revolution for fire hazard and risk.

Indeed, Saudi Arabia has a very strong tribal culture, with the majority of tribes descending 1400 years back from a companion of Prophet Muhammad (PBUH). Back then, tribes formed the basis of a social structure, and could be based on multiple dimensions related to familial ties or formed around a leader. In Saudi Arabia, irrespective of the foundations, multiple aspects of everyday lives of individuals owe their everyday existence to the attainment and continuation of the tribal code and structure in society (Franz 2011).

The majority of respondents agreed that tribalism seemed to contribute significantly to corruption in Saudi society, with Mohammed Khalil, senior trainer of twenty five years' experience, of the perspective:

“Tribalism is a very prevalent form of corruption and even affects resource allocations in our sector. A member would go to any legal or illegal extent to protect the interests of a fellow tribal companion, and people are very proud of this. It is

similar to the Freemasons in the UK, but the Saudi tribal code is significantly more pronounced and explicit than anything comparably Western societies.”

Abdullah highlighted that:

“The international community very well knows the strength of the Saudi tribal code, and anyone who has once dealt with the Saudis would always remember this aspect. Unfortunately this should not affect our sector or any other lifesaving service like healthcare but it does in our country.”

Tribalism is hindering progress in our sector in Saudi Arabia. As one respondent explained:

“The effect of tribalism is unfortunately huge in our provision of services. So, irrespective of whether you are an individual consumer or representing a conglomerate, if you can prove your lineage to any of the tribes of your in, you have all the freedom you want installing reduced fire procedures and equipment. Otherwise, be prepared to wait in line for an extended period”.

Another Jeddah based trainer, Salam Yusuf, commented that:

“The majority of rules and regulations ratified are intended to protect the interests of the few well connected elite from amongst the dominating tribes, which adversely is a barrier for everyone else. You would imagine this is not present in the fire services but it is. If we get a call from someone senior like connected to royalty obviously we have to prioritize them!”

The aforementioned is a classic example of the problems the fire sector faces. For most Saudis, the surname is an indicator on the lineage and prominent

associations in this regard would ensure that they would perhaps receive preferential favours and services even for fire services. Naturally, the exhibition of blatant nepotism and favouritism is but the negative result and demonstration of the adverse effects of tribalism at its basest.

Throughout its modern day history, tribalism has been an integral part of the Saudi cultural setup. The Bedouins roamed the vast deserts and Ibn Saud organized and brought everyone on-board towards a unified structure. Those who refused his dominance were defeated in battle during the period of 1902 through the 1920s. Total political dominance was obtained by the tribe in around 1927, and the Saudi Kingdom was established in 1932 (Franz, 2011).

The dominance of the tribes in Saudi culture continued unabated during the succeeding decades till the discovery and consolidation of petroleum in the 1960s. Considering the central position of the modern day Saudi leadership and dynasty in establishing the Organization of Petroleum Exporting Countries (OPEC), and leading the organization down its current path, and observing the power it held globally in light of the two petroleum boycotts it coordinated, the present tribal leadership is very much here to stay in Saudi Arabia (Ehteshami and Wright, 2007; Franz, 2011).

Abdullah commented that:

“It is imperative for the current Saudi leadership to ensure that the tribe is kept in harmony to ensure that the current status quo is maintained. Towards this, members would look out for the interests of one another and support each other whenever and wherever possible. For a Westerner, such behaviour would be detrimental to the long term interests, but is a way of life for an Arab. However it must not be present in life saving services like ours or hospitals”

Majority of the participants were of the view that in order to handle the problem of tribalism so that it does not significantly influence fire services, it is necessary that in the future developmental plans, the effects of tribalism are phased out. As described by one senior manager:

“The elite bourgeois group of Saudi society is a major part of Saudi tribalism, and not only the royal class, as commonly considered. The actual culprit of Saudi tribalism is regarded to be the bourgeois clan. Policy making initiatives need to slowly phase out this relationship with the bourgeois”

“The bourgeois clan is an influential group and connects all the activities in Saudi Arabia; so much so that the government would collapse without its support. The king is also dominated by this clan and they have the power to modify the manner in which society functions in Saudi; interestingly they control Saudi society not the Royalty. All in all, it is a known fact that not the royal class but the bourgeoisies are behind everything that is important. Targeting them is therefore key to any change. “

The majority of the interviewees stated similar conclusions in their evaluations. 12 of the respondents stated that the new rulers of Saudi Arabia would be able to bring about the change and it is not the responsibility of the religious clients, Ulema, of Saudi Arabia. The Bourgeoisie must be held responsible for the act. The Bourgeoisie was usually silent in the cases of politics and only held the real power in government corridors as well as the Royal family. It is due to their silence that they were dismissed as not having enough power.

Nearly 500,000 people, or 3-4% of the population, were represented by the Saudi bourgeoisie (Lucianai, 2005). These individuals who are represented are not only the wealthy families with billions of dollars but also the entrepreneurs,

women entrepreneurs or smaller businessmen who have registered with the Chamber of Commerce. Saudi Arabia has been termed as the most prevalent bourgeoisie cultures throughout the world as the net worth of thousands of families in the State is above \$100 million (Luciani, 2005).

The lower layer of families have a net worth of above \$100 million but less than \$1 billion and this includes the Saudi diaspora families as well. The upper layer consists of those families that have a net worth of more than \$1 billion. The diaspora families have travelled all over the world to countries like United States, Japan and Europe in order to gain vital knowledge regarding business activities. Their international connections have helped them form strong international connections and have become multi-ethnic. The globalizations process has become extremely rapid and these individuals are now able to understand and adapt to this change. Their excessive knowledge allows them to be comfortable with the Global Big Business environment and their children are being educated in the best schools of Europe and the USA. International partnerships have been consolidated domestically with the help of these families who have established themselves abroad and have also remained within the State.

Every 5 years, the bourgeoisie class plays a vital role in the drafting of the development of the government. This role has been explained by Abdul Majid. He states that the key advisors of the King are the elite families of the nation which include the al-Zamalis, the al-Rajhis and the al-Walids. The global marketplace is progressing at a fast pace and this change will not slow down for anyone, even Saudi Arabia. Hence, it is essential that the economy moves fast accordingly. The large economic families of the nation must take part in the development of the

technology, voting rights, education and driving of cars of women. Families who are rich and may be richer than the Royal family have the ability to bring about change as they are at the top. Individuals outside Saudi Arabia must understand this aspect clearly.

Abu Bilal brought forward the idea that any change would fail to progress if the bourgeoisie class does not approve of this change. This class needs to provide its assurance before the King is able to announce the change. The bourgeoisie class must recognize the matters present in the society and implement changes within their own class as the first step. Without this act, the rest of the society would fail to change their attitudes towards these matters. The most senior leaders of five government departments are also part of the bourgeoisie class but it has been clearly mentioned that the real power belongs to the large families of Saudi Arabia.

The main issue present in the case is that the bourgeoisie class is the actual reason behind any initiative taken by the government or any successful activity which takes place within the Nation. The initiation and influence of the government initiatives is heavily dependent upon the bourgeoisie class. Keeping this aspect in mind, the issue arises that the bourgeoisie class is very much focused on conducting operations abroad. If they were to shift their focus and attention from the international entrepreneurial activities and projects, Saudi Arabia would be able to arise as a strong global powerhouse. The notion that this class needs to focus internally on social problems now and give something back to the poor in Saudi society and therefore help develop a fair and just public system was prevalent in all respondents.

4.3.5 Bureaucracy

One of the primary factors restricting the free flow of information within the fire sector in Saudi society was regarded to be the time consumed by a particular affected individual to lodge his emergency call together with the difficulties associated to lodge any subsequent complaints. Also, when it comes to procedures and paper work, it was mutually agreed by all that the Saudi government and the concerned administrative offices responsible for administrative dealings were absolutely incompetent. A major sign of this inefficiency was agreed, by all informants, to be the amount of time consumed in lodging a call.

When it comes to reducing 'red tape', the government led bureaucracy is blamed, as most informants regard it as incompetent and a hurdle. According to the view point of informants, many affected individuals took a back seat because of the inefficiency of Saudi fire response system and this inefficiency is the outcome of government time delays in dealing with significant policy recommendations already made to upgrade communication capacity. Bureaucracy is often considered as the culprit of tribalism in Saudi administrative system because it is frequently linked to be an important part of the manner in which the tribalism operates in their culture; the reason being that there are more chances of favoured dealing at every point of the bureaucratic involvement when the amount of bureaucracy operations and measures are more.

Particular users of the system are bound to be influenced at interpersonal level encounters if there comes any modification in the bureaucratic system, i.e. if the system leans in favour of those attached to particular tribes. When it comes to developing and emerging economies, inefficient bureaucratic systems are common

and they result in efficiency problems (Magnusson, Westjohn, Gordon & Aurand, 2012). When a public policy has useless governmental structures or when the level of human resource development is inappropriate, it results such traditional type of incompetency (Assunção, Forte & Teixeira, 2011).

Being an entity, a particular bureaucratic entity has to implement some form of responsibility as its target is to offer an impersonal way of applying power in a society. In order to fabricate an organizational setting that supports the possibility that the employees are competent to execute their delegated jobs, management of employees, and also to ensure that the results of bureaucratic procedures are according to the expectations, this impersonal trait of bureaucratic operation (Goodsell, 2003). There was mutual agreement by many informants on the issue of the overall removal of Saudi culture from the standard targets of bureaucratic operation and that the latter paves the way for tribalism and that eventually leads to corruption. It was debated by several respondents that:

“Bureaucrats make sure that they accept, execute and practise the normal operating procedures so that it paves the way for the effectiveness and certainty of results. This is true for countries like Germany or the UK that are perfect bureaucratic operating societies; over there the structure of laws exist that are authorized by law or the governing authority. In a disciplined and competent bureaucratic framework, in order to guarantee the competency and the certainty of results, it is assured that there is useful distribution of labour amid the employees of the company. This is possible in an ideal situation where people are not appointed to jobs that they are not trained for. On the contrary, in Saudi, if someone has contacts and there is a force

behind him he can reach the highest position, thanks to the bureaucracy, irrespective of his qualification.”

It was declared by one respondent, Abdullah-Latif that:

“When reading an article some time back in FT, it said that on the Global Corruption Index, out of 174 nations, Saudi Arabia claimed 44th position. As we all know this and it was further explained in the article that there was more margin for corruption in Saudi Arabia because of the several layers of bureaucracy in the Saudi system”.

4.3.6 Burns centres

Most respondents cited the importance of having improved ‘burns centres’ and units in Saudi. They argued that large cities mostly consist of the burns centres but the number of these centres is not enough to be able to cater for the high incidence of injuries. People usually have to travel long distances and the transportation methods are poor which is why there is a delay in resuscitation. There exists lack of time, resources and blood at most of the burns centres to cater to the injured. The burns care unit does not contain formally trained burns or general surgeons and the ones present have low dedication levels. There is no recognized concept for burns nursing. Hence, all these issues cause a large percentage of patients to suffer and excisional surgery is not possible. The tertiary burns centres and district hospitals seem to have no coordination whatsoever. As Salam explained:

“with the money our government has our burns units and training of nurses should be the best in the world but far from it, we have queues of days, not hours in this country with many going home and doing self treatment because they can’t afford

treatment or to be seen to and you know the reason, because there is no wasting! (tribal connection)”

Yusuf, who had overseen the training for several hospitals on fire hazard management, explained:

“Even our hospitals do not have the facilities to deal with fire, let alone the treatment and staff to offer specialised services. We need huge investments in our hospitals to take them to a global standard. Prevention programs need to be put in place”.

Several respondent explained that prevention programmes must be such that an individual is able to apply it easily within his lifestyle. They should take into account all environments and behavioural changes present. High risk groups should be targeting and execution of this program must be done with precision, persistence and patience.

The burns prevention unit is included within the national programme depending upon the population of the nation. There should be strong coordination amongst the regional, tertiary and district care centres along with the availability of sufficient funds. In the presence of a central registry, it would be possible to manage the records of compulsory reporting and the data could be used for evaluation of future strategies and prevention programs. Manufacturing standards must be set by the law for the following aspects.

1. Heating and electrical equipment manufacturing
2. High rise buildings fire safety standards
3. Explosive chemical handling
4. Transportation and storage of hazardous materials
5. Firecracker storage and transportation

The healthcare staff part of the burns care unit must be educated efficiently by the national body of burns professionals.

Mohamed Jamal highlighted:

“Limited resources are present for the assistance of the burns care patient. To manage large scale patient care, it is essential to maintain a strong infrastructure. With the development of regional centres, it would be possible to conduct training of the burns care staff and carry out tertiary management. Referral procedures must be decided upon and the general surgeon’s part of the district hospitals are to be given the responsibility. They can manage this task through the formation of the nucleus of the burn care service. After two to three weeks of stabilization, the referred patients can be discharged as it might not be possible to retain them at the burns centres for 6 to 8 weeks. At home, using primary health centres or then at district health centres these patients should be provided the care they need after being discharged. The primary health centres can act as a strong link between the district hospitals and the burn patients. There is low presence of incidence of burn wound septicaemia with domiciliary treatment. It is required that the patients be readmitted for skin grafting, blood transfusions or treating septicaemia. Many things are needed! But this is a start”

Another respondent with experience in developing policy for burn units, Rashid, highlights this detail:

“To cater to a large number of patients using limited resources, there should be a well-tested and cost effective treatment procedure to be used. These procedures should include using amnion as a biological dressing, Parkland formula for resuscitation and pursuing conservative burn wound management. Trained staff is

usually brought about after the vital efforts of hospitals. The basic aspects of burn care must be taught to nurses or doctors irrespective of their specialities. They must always be included in the development plan. An anaesthetist and respiratory physician must also be present with the burn specialist as part of the disaster management team. The staff deployment process should be judicious as well as prompt. At the hospitals as well as the site, a team of psychologists should be present who manage the panic amongst the victims of the disaster as well as their relatives. The patient flow from the disaster site to the actual area of healthcare facilities must be carried out by the clinicians experienced in burns. The inner facilities are the primary and secondary care hospitals and the outer circle of healthcare facilities would include the burns centres and the tertiary healthcare hospitals. “

4.4 MEDIATORS

4.4.1 Knowledge

With respect to fire based disaster management, the most vital information required in the beginning is whether a fire has actually taken place and if relief or management of it is required. This information appears to be quite straightforward. However, when there are political inclinations in this management, it does not stay so simple. Disaster relief essentially turns bureaucratized when it is centralized and handled by the government. The central disasters department is one of the government bodies that have been developed to look after all relief or hazard activities. Government agencies, in turn, manage these agencies, with each one having its internal bureaucracies, and so forth. There is one important management

figure at the top of all these bureaucratic layers, who is the director, and who has to announce a major fire before local operations can even start their operations. The larger the fire the more bureaucratic this process. An important political decision-maker needs to provide his consent at each bureaucratic level before the suggested action is deliberated upon at the following bureaucratic level. Bureaucracy is a vital and inevitable outcome of activities handled by the state. It is essential since government agencies, in contrast to private agencies whose activities are directed by profit seeking; are not guided by any such objective (Mises, 1994). As Mashal, a training officer, explained:

“Information flow is critical, sometimes in our system especially with major fire crisis where we may need multiple agencies or stations to get involved then the local chief officer has to get permission from the director’s office in the region which can take many wasted minutes. Local offices should have the flexibility to decide operations themselves but regional offices argue that they need more information to ensure cost effectiveness of operations”.

Said Umar Farouk, a senior manager of ten years’ experience, argues that:

“The steps through which information has to flow before operations can proceed increases the bigger the fire hazard. House fires don’t need permission from the chief but larger building fires and multiple building dwelling fires need not only the local chief’s but sometimes local director’s permission. This process can take valuable time”.

The theory on ‘red tape’ or bureaucracy processes basically claims that differences between private and public objectives of institutes determines levels of bureaucracy. Private organizations pursue profits and so their managers essentially

have one aim: profit maximization. Those managers who make efforts to attain the firm's objective and generate profits are retained and compensated, while those who do not do so can be reprimanded or even fired. Managers determine the contribution of managers through monetary profits and losses.

On the other hand, government organizations do not have a single rule for their "political managers" as these agencies do not seek profits, nor do they sell any goods; hence, they cannot guide their managers actions and ensure that they are working towards the organizational objectives through profit/loss estimates. Therefore, they require another guide for directing manager activities and another tool for determining the attitude of political agents. It has been stated by Gordon Tullock that where there are no profit-and-loss systems to determine and ensure that political managers follow those activities that are consistent with their organization objectives, "The main problem ... is organizing subordinate politicians so that they will act as their superiors want them to act, as much as possible" (2005, 132). Bureaucracy is the political means of attaining this objective. Instead of profit-making goals, extensive processes and protocols should be employed to guide and monitor political managers' actions.

Bureaucracy is inherent and important to government bodies for attaining this objective; however, it is not necessary that all of its influences are going to be constructive. There are extensive protocols that consist of several layers of approvals. These protocols ensure that prior to any action, political agents do not get involved in activities that are different from the agency's objective. They also significantly decrease the pace at which government activities and information revelation takes place. For instance, in the process of declaring a 'major disaster',

the government does not provide information about a disaster requiring relief aid until the protocol for disaster declaration has been fully implemented. Those political agents who are responsible for relief activities for the disaster do not believe that a disaster has taken place till the director or minister in even larger scale hazards, who is contacted in the last stage of the bureaucratic process, has officially announced it. This is despite the fact that the disaster has already taken place and requires public help and has been already acknowledged on the media. Bureaucracy in government management is inevitable and leads to a distinction in what might be referred to as “private knowledge” and “political knowledge” of the disaster. A “knowledge wedge” is created because of this bureaucracy that puts severe restrictions on the ability of the government to attain its objectives successfully. Tullock stated that, “it needs to be highlighted that these constraints actually limit what can be achieved, and not the size of bureaucracies that can be constructed. In addition, these constraints are quite less if the activity that is to be carried out needs a lot of coordination as compared to when it does not require any” (2005, 170). When the task requires coordination to a large extent, the bureaucratic knowledge wedge becomes greater and hence, the chances of the government fulfilling the task successfully also decrease.

As Abdul-Kareem highlights:

“The word bureaucracy often comes to mind but this is not something specific to us in fire safety. This is throughout our country, wherever you go in whichever sector of life what you say in England, paperwork, has to be done but paperwork for safety decisions should not delay the officers to go out to help put out the fire but I’ve known at least three cases where we had to wait for our director’s signature before

we proceeded to put out a large mall fire and in that time I'm sure more damage had been done which could have been prevented had we gone in immediately".

Abdullah Al-Haleem, a senior manager responsible for training in over fifty fire officers, stated:

"sometimes I think I have more forms to fill in and more signatures to secure than fires to put out!"

Abdul-Hamid tried to explain the background of this problem further:

"As compared to private individuals, government employees have even less motivation to gain information about the areas that require resources immediately and to make sure that their resources are generating value even it is linked to health and safety. This is also true when they are distributing resources of private parties. Individuals are generally not as cautious about the resources of other people as compared to their own."

Once it has been determined that a disaster has taken place, the things needed and their recipients are ascertained followed by action to improve the situation. The final information that is critical for effective disaster-relief management is feedback regarding whether the plan of action being followed is actually effective. It needs to be determined whether the victims' requirements are being fulfilled. When compared to the private sector, it can be seen that the government is unable to obtain this feedback. There is no effective feedback system with the government because the resources held by the government are not mainly influenced by performance. Hence, the political players do not know whether their activities have to be expanded, adjusted, or completely eliminated. They are only aware of the

financial expenses of their activities and have no feedback regarding the effectiveness of these activities (Mises, 1944). This makes it very difficult to economically distribute resources through the political process and also to organize the supply of these resources to those who need them. As Tariq Jameel, a senior instructor in fire training, comments:

“Part of the problem is that the fire services is not a learning body, we don’t learn and improve our services. Although our government has so much money some of our practices would be considered ancient by my instructor who taught us from Chicago. He was talking to our younger staff in their training last year about the need to progressively learn from feedback of previous and every incident. To have a database to map out metrics per fire incident. This system does not cost much but we don’t have it. This says it all.”

The majority of the sample were clear on the significance of knowledge generation and dissemination for the disaster management culture general and specifically for fire hazard management. The Saudi disaster management culture needed knowledge based innovation in order to generate the sustainable element which can further lead Saudi Arabia’s fire safety culture to become an exceptional one, competing and collaborating with the best in the world. Two major themes emerged under the broad theme of knowledge:

- a) The educational sector regarding disaster management training and research in Saudi Arabia was comparatively fragile even though certain positive steps were taken like that of King Abdullah’s scholarship programme which is providing assistance to young Saudis and study at all sorts of higher education levels abroad by means of a scholarship programme.

- b) There should be a strong bonding among public and the private sectors, and academic world in regard with the devolution of knowledge.

4.4.1a King Abdullah Scholarship Programme

Knowledge generation plays a pivotal role in the creation of innovation and a principal sign of the need to develop human capacity which will further assist in exerting a pull on the sustainability required by the sector. Furthermore, knowledge generation has become formalised as part of the government's development plans which uphold investments in the higher education resources inside the country along with the provision of supporting scholarship programmes for sending young Saudis to other countries for acquiring higher and best training and education as a top policy priority. Ahmed Said, a senior trainer who has been working for 35 years in Jeddah, commented:

“As per the world's GDP, currently we, the Saudis are acquiring the highest spending programme on higher education as King has taken admirable steps for fulfilling training needs of the next generation demonstrating his astuteness and insight in the apprehension of education for all sectors. He understood the fact that the only way to make Saudi into a knowledge economy is investing in knowledge, stating that knowledge is power and then we will have something to offer back.”

Others also pointed towards the King Abdullah's Scholarship Programme (KASP) which was founded in 2005 and has spent the cost of over \$5 billion for making it the most well-funded higher education scholarship programme all over the world. Moreover, KASP subsidizes about 90% of all Saudis studying in abroad. The scholarship programmes embrace payment, i.e. fees and a munificent stipend for three years which is habitually extended to two additional years, health insurance,

English language training, and supplementary funds for upcoming conference costs. Additionally, owners are paid with additional funds for the purpose of upcoming leave of absence of scholarship employees going abroad. In 2011-12, the funds were provided to about 130,000 Saudi students studying in 22 countries. This plan was actually developed for merely two years but upon its accomplishment rate, this scheme was further extended till the year 2020.

As per Mohammed Tariq's opinion,

“The KASP has seen extremely high accomplishments. Even my own daughter has acquired this scholarship and now she is a student of Birmingham University in the UK. I guess the government never expected to receive this many scholarship applications but Saudis have realized the worth of knowledge and training and this is why they are endeavouring to avail themselves of these scholarships. This was the thing that the King always desired to happen as he initiated this programme to see future success. It is obvious that if we don't educate our youth now then how they will lead our country towards development and prosperity in future. However, we are expecting when they come back home, that they will still know and respect their values and get back to the Saudi culture, which can become a great challenge for certain youngsters. Still we have an optimism that they will promote the value of knowledge and research in their organisations upon their return, set up their R&D units in the working area, and work innovatively in order to build human capacity in their home country for all sectors including ours. My daughter is in nursing for instance.”

As per the feedback of the majority of the participants, this educational programme was structured as a long-term investment in the country's human capital

in order to attain innovative ideas in the country, one day building human capital and therefore a R&D culture. However, this R&D culture has been seen materializing in a number of universities in Saudi Arabia with a number of success stories being present by means of massive government funding programmes for domestic higher education. The core objective of this dual higher education system is to create innovations by R&D through the development of knowledge in young Saudis and even this attitude was epitomized in various feedbacks through two kinds of programs. The first one is spending investment in abroad based scholarships while the second one is the investment in domestic universities.

“This educational programme was structured for making Saudis realize the worth of knowledge and to motivate them to build a knowledge-based economy and it originated as the 8th development plan of the government for the time period of 2005-09. Furthermore, there was the aim of digitalizing and updating everything in the national ICT project by means of the Science and Technology National Policy. Subsequently, the 9th developmental plan which was introduced for 2010-14 further improved the role of education in the development of Saudi Arabia in the form of an R&D hub all over the world. There is no reason with our money we cannot become the hub in the Middle East for disaster management”

The government was striking hard to develop such developmental programmes which directly concentrate over the significance and application of education in Saudis; becoming the main precedence of the Saudi government for the development of socio-economy while aiming to acquire autonomy and self-sustainability from foreign expatriate employees. As per House (2013), these foreign employees, specifically from the ARAMCO, increased in numbers between the oil

and petroleum golden period rising from 1975 to 1985. The next challenge is to generate this type of momentum in the public sector. Indeed, the majority of the participants refer to this as an indication of improved state policy.

In this regard, Abdul Majid put forward his opinion that,

“The government has spent billions of riyals to improve the educational system of universities and research centres with an objective to build a knowledge-based economy while making Saudi Arabia, a hub of research excellence globally. He further said that we are currently the leading researcher in the oil and petroleum sectors with the organisations throughout the globe struggling for the contracts in the enormous university economic cities. However, majority of the organisations are influenced by the National Science and Technology Plan (NSTP) in terms of knowledge or technology creation. Even we can provide with funds for unifying the big research hub centres to create fire hazard research and practice hub, we are now doing this for nursing and midwifery so why not for other public sector bodies like ours, with time, Insha Allah.”

The NSTP can also be considered as one of the lending hands in promoting a sense of research-based culture with the central Saudi government. Moreover, in the NSTP overseas, majority of the science and technology based state is involved building on private programmes while helping in the financial assistance of these programmes or developments.

The statements of Hamid Sara on this matter are as follows:

“In order to strengthen the private sector, we are endeavouring to utilise knowledge creation by spending 12% of the national GDP over it while making it an enduring

investment. But the chances of economic liberty can merely be seen when the graduates from abroad return to their country and effectively apply the skills and knowledge in their organisations, increasing new innovations, and enabling them to contend with the other firms in the global market.”

Certain respondents have declared the case of KAUST which serves to be a Saudi assimilated university, established in 2009 by the Saudi ARAMCO. This university is the largest funded university and LEED (Leadership in Environment and Energy Design) campus in the globe, in which women students do not have to undergo restrictions which women in other universities face all over the country. No doubt, KAUST has become progressively more recognized in the world for its superiority in certain research fields as per the opinions of Adams et al. (2009). In this concern, Abdul-Rahman has stated that,

“KAUST was just established in 2009 and has gained global leadership: even professors throughout the world desire to visit KAUST. How were we able to make this accomplishment? Just because of the funding of our successful mother industry of oil and petroleum, which is referred to as our cash cow, while the private sectors and education are our stars, so we just require 20 years and then our public sectors will also be present in the global marketplace. “

This assimilation of government policy, private sectors and universities gives the new economic structure endorsed by the governmental knowledge-based plans upheld recently. The majority of the participators discuss the ‘Triple Helix concept’ present in the consequent segment which is known to be the second level of the governmental plan based on knowledge creation. This theme is discussed below.

4.4.1b Triple Helix Concept

The Triple Helix conceptuality is the foundation of a structure through which a country can prosper in terms of knowledge economy development as described by Etzkowitz and Leydesdorff (2008). A knowledge economy refers to the creation of economic advantages by means of applying knowledge technologies (Brinkley, 2006). Knowledge technologies refer to those technological developments commonly known as high-tech in accordance with the opinions of the Organization for Economic Co-operation & Development (1996). As per Smith in 2000, other people regard knowledge technologies as:

- (i) Production of knowledge-intensive industries like creative industries, and
- (ii) To build up the extensively reachable disseminated knowledge bases which facilitate the optimum utilisation of knowledge technology.

The core elements of the Triple Helix include government, industry, and academic world. As per this structure, the academic world is effectively involved in the detection of innovation, while the government advances the procedure by means of developing facilitating policies along with the incentives provision, and the industry produces the functional and practical innovation treatments. The key component of the Triple Helix arrangement is considered to be the R&D based innovation generation and has even been suggested as a principal element for the progress in Western nations (Leydesdorff and Etzkowitz, 2008).

The economic liberty in Saudi Arabia enabled knowledge creation and the ability to disseminate or transmit knowledge freely among partners inside the Saudi society, and specifically between the academic world and industry, under the guidance of the government. 11 participants linked the Triple Helix model with the

confluence of knowledge transmittance among academic world, industry and the government, indicating that our sample is well-built along with the Triple Helix structure of innovation creation. However, all 11 participants suggested that the Triple Helix arrangement is the core element ascertaining the production of innovation in the Saudi fire hazard management culture.

As per Abdul Kareem,

“We are on the road to progress and development although Saudi Arabia is not at the zenith of the world’s league tables in R&D expenditure but our government desires to spend 2% of its GDP in the R&D as I have read somewhere. This indicates that huge investments are accessible to us for our higher educational sector which has already initiated, and persuade our managers to create knowledge-based transfer partnerships with university lead R&D units. The Malays have undertaken the Triple Helix system for creating innovation by means of cooperation and this is what we should be required to do.”

In review, going over the replies summarized from respondents, it is concluded that they are very well aware of the Triple Helix concept. This was to be expected since the majority of respondents were experienced professionals who regularly attend training conferences globally in management, leadership and policy. To conclude, multiple individuals proposed a transfer of skills and processes accrued from the oil and petroleum sector to the public sector which would contribute towards skills, training and overall capacity building. Therefore, Abdullah Al-Harlem, Sadiq, was of the perspective that the petroleum and energy sector had contributed much to global innovations, while the public sector was correspondingly weaker in this regard.

“The public sector has so much capacity for input from the petroleum and energy sector, considering the former are leading in the Triple Helix concepts. To illustrate, the Dhahran Techno-Valley (DTV) project is collaboration between ARAMCO, KFUPM and multiple techno companies, and everyone wants to be associated with this initiative. The project is contributing to huge advances in energy sector solutions globally, although it could be argued that ARAMCO has almost unlimited financial muscle and is amongst the most successful FDI projects till date in the world. With WTO now based in Jeddah other public sector initiatives could for partnerships with Saudi academia and why not those involved with Fire Safety, we have the money surely we can attract global fire safety experts to us”

Various other respondents in the sample were unanimous in recommending the Triple Helix model for advancing innovation for the fire hazard management sector and thus become worthy of emulating how the private sector has done in Saudi Arabia. They further recommended how the Saudi Triple Helix could be improved upon by partnerships between a foreign fire safety academic unit, and local research institutions, with the government contributing towards facilitating these partnerships.

Correspondingly, Jalil is of the perspective that:

“To ensure the success of the Saudi Triple Helix model for the fire safety sector, it is important to these partnerships as being very much related to the equation, which would contribute to increasing the pace and facilitating the process towards sustainability. This could as well be achieved by properly and meaningfully utilizing the extensive educational and R&D infrastructure already in place, besides making additional investments, considering the willingness of the King in this regard.”

The Triple Helix model, related to fire safety, is a key mediator therefore in the development of a long term strategy. A key outcome from the sample was the generation of innovation as a direct result of knowledge generation through this Triple Helix arrangement. The discussed in the following section.

The objective of the Triple Helix concept is to start a process which would provide for innovation from existing resources initially (Leydesdorff and Etzkowitz, 2008). Therefore, to this end theorists are in agreement that it is imperative that aspects of science, the market and technology are all in alignment to each other which would thereafter contribute to innovation in society (Tidd et al., 2001). Correspondingly, the Triple Helix theory is increasingly gaining widespread recognition and acceptance across all spectrums, even in developing economies (Saad, 2008). On a related note, the concept of sustainable competitive advantage was initially proposed by Michael Porter in 1985, in which Porter (1980) theorised that in order to be competitive in a particular sector, including the public sector, a nation had to have certain specialities to generate consumer demand processes in that area, which the competition otherwise lacked. Subsequent theorists refined this concept to state that it was necessary to make the entry of new competitors a challenge to ensure the continued dominance of the initiator, which in other words called for on-going and continued innovation and refinement (Porter, 2000). Therefore, in this regard innovation based sustainability in the fire hazard sector could play a crucial role in ensuring that the nation retains a competitive advantage.

Abdul-Majid Ali is of the perspective that:

“It is surely challenging for our sector. Once our students complete their PhDs and studies from Western and American universities, it is hoped that they would return

home and with their talent, initiate a process of R&D in our sector. The process has already been done in the petroleum and energy sector with outstanding results. Hopefully, this would also be replicated in our sector now.”

4.4.2 Technology

4.4.2a Information and Communication Technology

The role of technology was found to be the central enabler through which knowledge, management and regulations could develop human capital and reduce fire hazard risk. Technology is positioned here as the first key enabler. This should come as no surprise since in disaster management theory technology has gained in importance given the recent developments in digital and software technology in managing complex information.

The use of technology in general disaster management has a long and strong history. For instance, in expert radio operators have been an important part of the disaster management cycle, and this “hobby technology” has been found to be very important for communications in those areas where other telecommunication networks have not been successful (May, 2006). The Internet is not as infrastructure free as the amateur radio is, however, it has been used to enlist volunteers, communicate between volunteers and for other relevant activities. When the infrastructure is still available, people use collaborative or social technologies for other information uses. For instance, in summer 2005, a people-finder blog was created by a group of bloggers in Mumbai, India, to assist people in finding family members and friends following storms and floods in which thousands of people lost their lives or were displaced. Following Katrina and Rita hurricanes, identical listservs and Katrina People Finder, which links names and data over other

databases, played an important part in assisting individuals reach their families and friends (May, 2006). Up until now, the efforts of the communication technologies in offering relief and reinstating communications in struggling Gulf regions have not been completely acknowledged. The knowledge available, however, presents various ways in which community technology programmes, fire safety and related disaster management can work.

Simple installations such as wireless and telephone technology masts might be able to assist faster transmission of fire emergencies to fire stations. At the forefront of using technologies in fire and general disaster management has been good practice emerging from the USA.

Abdul-Kareem, who has recently attended a conference on the use of technology for fire safety in Montréal, Canada, commented that:

“It was fascinating to see how firefighters in Canada are using technology. They had examples of firefighters being able to see the fire through masts in the region remotely. An area of 1 square km only need eight of these special masts and the fire station can estimate the size of the fire through remote visual cameras connected to the firefighters phones through a special app. What was most interesting is the heli-tech-opter. A small radon controlled helicopter which flies in and around fire areas, able to navigate to the fire hot spot. Even more radical was the idea of a Chicago fire station using mini helicopters with foam hoses attached to reach remote areas.”

Mohammed Salem, a doctorate in fire safety and now a professor teaching fire safety management courses throughout the Kingdom, highlighted:

“I went to a conference in Tokyo on using ICT for fire safety and we were showed how firefighters in some quarters in Tokyo are now using locally trained volunteers in regions equipped with instant access to fire stations with remote signalling and wireless transmitted imagery. Another innovation we saw was the use of video enabled mini helicopters being equipped with hose facility from the ground up, I’ve never seen this before.”

The use of training volunteers as “trusted reporters” and enabled with technology to instantly relay pictures to the incoming firefighters was a commonly expressed view. Several respondents cited this approach as practical and feasible for the Kingdom of Saudi Arabia. These volunteers would be offered training and would form part of a voluntary fire service in localities. As Yusuf, a former fire station chief with over twenty years’ experience, highlighted:

“This system I have seen in Los Angeles. In Beverly Hills, there is a fire station which has its own voluntary fire service team. These people are fully trained and have in their houses semi specialist equipment but their main duty is to relay instant pictures to incoming fire fighters is they become their eyes before they arrive on the scene. They also have fire blankets and shields and are trained in using them as well as training in connecting fire hoses and using them together, remarkable really”.

This volunteer fire safety can be traced to concept of Citizen Emergency Response Teams (CERTs) commonly arising in North America. In this approach, volunteers in the CERT corps are provided disaster management training and are encouraged to use their training to serve the community, an approach that could be employed with training in particular information technologies. A valuable model may once again be provided by the amateur radio community as it depends on the

individual initiative, however, it still needs training and license to take part in emergency management. Yet another method is to involve technology in disaster management classroom and vice-versa. Grassroots volunteerism is encouraged by service learning through schools which may prove to be valuable in training disaster management techniques to Internet-savvy students (Steiner & Sands, 2000).

Other commonly cited approaches using technology were wireless and web based, and database management. Having basic demographic data tabulated was deemed a basic criterion for the fire safety culture in the Kingdom to move beyond the current status quo of not having such information recorded. Traditionally the postal service is seldom used and therefore developed in the Kingdom, and due to this demographic data matrices are seldom in use. Investing in such information recording for the benefit of more effective targeting of fire safety access is deemed critical. As Abdullah, a former station chief highlighted:

“we don’t even have a basic database of where residents live. It takes us longer to map out patterns in fire incidents as a result so we cannot develop targeted policies for different localities. We need some serious investment to build this information data warehouse first and then we can move forward. This is what will create a long term shift in our policy development and therefore performance”.

An interesting separate issue being raised by respondents linked to ICT was the use of media to educate the public about fire safety. Although linked to ICT, this area represents a distinct area in itself and is therefore discussed separately below as public education and communications.

4.4.2b Public education and communications.

Several respondents were keen to emphasise the role that public education through public communications could have on the public. Crisis communication was also mentioned within this issue as central but currently lacking by the fire safety department and generally by the civil disasters management departments. According to Reynolds and Seegar (2005) crisis communication originated from public relations and is based on strategies to form and manage public opinions of an event. It tries to explain why the particular crisis occurred, and the possible consequences, in order to offer relevant crisis-alleviation information to the affected group of people. The goal of crisis communication is to decrease uncertainty, react to and solve the situation and to learn from it (Ulmer et al., 2007). Although much of the crisis literature deals with one off events such as natural disasters or large scale events, daily crisis could also be subject to this type of communications, i.e. a strategic crisis communications policy could be developed to tackle lack of education concerning fire safety for instance.

According to Abdul-Majid who has developed pilot communications for several emergency response situations in the past,

“There needs to be regular communication during fire based crisis management, and there needs to be open decision-making in such crisis situations. When there are opposing views of authorities, a state of confusion arises which gives way to greater uncertainty, and therefore, intensifies danger, therefore there must be a standardised communications policy to educate the Saudi public on fire safety risks which can then be disseminated at regional levels. Local stations could report back on the need for any adaptation of the communications to suit local needs”

The responses gained from this study are consistent with the literature on crisis communications and indeed it is interesting to note the overlap between views expressed and the classic crisis communication model highlighted by Reynolds and Seeger (2005). According to this model, crisis communications should begin before the event but continue till after it too and use a combination of tools to maximise education. Abdul-Aziz, a former regional planning director for fire safety explains this for instance more fully:

“it is important to communicate about potential fire risk throughout the lifetime of the public, starting at the earliest possible age during school terms. This should then also continue in homes and workplaces and separate communication messages should be developed for different public life stages and environments. Teachers can be used more for pre-college public, and even local Imams are encouraged to educate the public about fire risk. But the communication material needs adapting of course keeping the same core message, about fire safety risk.”

This issue of adapting communications for crisis for different stakeholders is also expressed in the literature (e.g. Vos & Schoemaker, 2006). Therefore there was widespread acceptance in the sample that communication should be adjusted in accordance with the requirements of the stakeholders. In this regard, stakeholders essentially refers to groups of individuals and communities who are directly a part of the crisis situation to a certain extent, the media as an intermediary player and for carrying out internal communications, other response institutions that are part of the network of actors. As Abdul-Kareem observed:

“Individuals require information for different purposes and have different expectations from response institutions. Communication would be effective when stakeholders’

opinions are supervised, and this would help in gaining an understanding of the thinking patterns of different groups. This implies that across the different stages of a crisis, the communication requirements of citizens should be monitored. When messages are consistent with the requirements, values, culture, background and experience of the audience, they are likely to be more effective.”

Several respondents pointed to the need for better research to be conducted before such a communication based education program could be utilized. It was also felt that communications should be adapted and tailored to deal with different types of publics in their experiences with fire disasters. As Abdul-Majid for instance explains:

“During the entire period of a crisis, it is vital to pay attention to the apprehensions and requirements of the civilians. A thorough assessment is required for comprehending the risk perception approaches of people. This could be carried out, for example, on their background and degree of knowledge and anticipations. Peoples’ experiences influence the way they handle a crisis. When the individual has not faced similar crisis earlier, the crisis response was more challenging due to insufficient understanding. Explaining the likely risks that may not seem practical or are difficult to understand is also considered to be a challenge.”

Predicting the course of events of a crisis is not easy. However, response teams need to rapidly and accurately analyse the situation and avoid making extremely optimistic predictions about an issue, as has been mentioned by one of the respondents. In addition, they should avoid ignoring peoples’ fears and apprehensions. However, the stakeholders are not a homogenous or simple group, and this needs to be considered during communication planning. It was asserted by

the respondents that it is normally perceived that in the initial response phase, communication should occur in a more standardized form while in the later stages of rehabilitation and recovery, more intricate forms of communication are required. This was considered as being the likely cause of gender insensitivity, for instance, in the early relief activities, or of ignoring people with disabilities in the emergency response to a disaster. The first stage of crisis response also requires precise targeting. The different stakeholder levels of the emergency have to be taken into consideration in the message (individual, community, family, ethnic group, province and so on). In the early part of relief operations, the message is essentially aimed at a narrow and extremely vulnerable group; however, later on, the target of the message expands as the main concern moves on from relief to restoration and finally recovery. It is not easy to identify stakeholders and keep a check on their expectations and to dispatch the actual messages. Those groups of people who are affected might be dispersed in various areas. It is important to have widespread communication that involves different methods and channels because people have varied media consumption patterns. Furthermore, it was asserted by the respondents that civilians might not be able to recollect the information provided which is why they proposed using a combination of approaches, for instance, strengthening oral messages using written reminders. The social media also needs to be considered when educating the younger civilians.

4.5 SUMMARY

Any government in the world has the core function of protecting the citizens of the nations from harm or disasters. It is an obligation upon them, which requires that all broad disasters must be managed (Comfort, 2005). A disaster can be identified as

a situation where the external event causes an interdependent cascade of failure and is worsened by ill planned activities and less information by an organisation or even an individual (Comfort, p. 338). The elements of this definition must be discussed in order to thoroughly understand its level of significance. In the U.S. context, the interdependent failure cascade is essential for mentioning since the disaster and emergency management system is the responsibility of the local government and the federal and state assistance only comes in when the disaster is extreme and cannot be managed alone. A vertical coordination amongst the government levels must be present to carry out the response, preparedness, mitigation and recovery process. A horizontal coordination amongst the local governments along with public and private coordination would also help achieve the roles and responsibilities in an efficient manner.

It is believed that a bottom up capacity is present for all diffuse and collaborative emergency management networks (Waugh, 2003). Hence, at a sub-national level, there would be extreme variations in the commitment and capacity for achievement of the effective policies (Burby and May, 1997). Failures occur as the probability of break down is present within specific points of a densely interdependent system. The adverse effects may worsen if inadequate planning is present along with a poor decision making capability of the organisation as a whole. Professional analysts and disaster research scholars have thoroughly analysed the deficiencies in the planning systems and the inappropriate decision making carried out by governments in the case of hazardous situations. Individual and organisational activities have also been well documented for reference.

The definition also stresses the fact that there exists a triggering element which must be considered and the researchers should treat this issue in a proper manner. Extant disaster research scholarship has been presented by Wisner, Blaikie, Cannon and Davis's (2004) study where a conceptual emphasis is present of fundamental importance. According to Wisner et al. (2004), hazards such as fires are not caused by singular extreme events that cause the disruption but policy design, planning or related considerations have an effect upon the understanding of effective management of these hazards. The disaster event core Risk can be associated with the problem of placing great importance to the natural hazard itself and not understanding the sociological root cause present. Hence, this drawback makes the humans vulnerable to the natural disasters.

Hence, it is recommended by authors to view disasters as inexorably linked to routine social operations, which are part of society or the community, rather than viewing them as a deviation from the normal social activities. The focus of investigation must not be to view the hazard as a separate distinct trigger. The risk of the disaster has also be defined as a compound function in which there is a hazard which could occur as well as the people who could be affected if the hazard occurs (Wisner et al.. 2004). The term vulnerability is defined as an economic, social or political process which determines how the people would be affected in different ways after the hazard takes place. It has also been stated that the characteristics of an individual or group as well as their situation determines how they would be able to cope with the issue, resist it or recover from it. This issue may be an extreme natural event or process, or a normal natural hazard.

When the space exposure, specific time, vulnerability of hazards and their variations are discussed, the researchers are actually stating the economic and political disparities which exist between the groups, assets and social protection levels. The distribution of assets would include information and knowledge, and social protection as recovery resources and disaster relief (Wisner et al., 2004). For example, when an earthquake takes place, it is the poor people who suffer the most as they live in less stable homes that are on slopes. This issue increases their vulnerability and also exposes them to higher danger levels when the hazard actually takes place. It is difficult for them to recover from such situations as they are already struggling to survive and meet ends. However, in some cases, the risk present with living in such an area is voluntarily accepted by the individuals like the coastal areas where the property cost is high to own. All over the world, the poor have placed themselves in areas where they can actually afford a livelihood and have opportunities to grow even if there is a high degree of risk present in living in such areas. Due to the constraints in economic opportunities, these poor individuals are subjected to a quasi- involuntary risk acceptance. Keeping these aspects in mind, it can be stated that vulnerability is affected by important policy making and therefore deliberate resource allocation decisions.

Disaster management is regarded as the cumulative set of decisions that are made over a long time periods. The potential change may be carried out through the process by which the actual choices are made. The vulnerability towards the potential hazards may be reduced or increased amongst the organizational, political, social, economic or technical situations within the nation.

The decisions made would function differently at organizational levels and in societal arenas but in a simultaneous manner. They would add to the operating system complexity and would definitely have an effect upon each other. A disaster has the distinguishing characteristic of never evolving. Specific disasters have specific measures being taken and these are the defining elements or the temporary solutions being offered for the crisis. The actions may be referred to for the management of the next crisis. The government system, region or community is shifted from a temporary state to another temporary state when the disaster occurs. The disasters are able to establish vulnerability within the nation, which is why reconstruction becomes extremely essential. This reconstruction would help restore the economy only up to the previous mark. The management does not focus upon reducing the recurrence of this disaster. Some of the actions may even be responsible for establishing vulnerability in certain areas for the next disaster to take place.

National and international participants which include the private, public and non-profit organizations must participate in addressing the issues of disasters which are on-going in nature rather than being occasional. The hazard must be reduced as a collective effort by these organizations. Special demographic and social groups are highly affected and find it difficult to recover during a disaster as they are vulnerable to losses. The prevention, recovery and mitigation programs must take into account the disabled, ethnic minorities, old individuals, young individuals or the women (Fordham, 1998; Oliver-Smith, 1991; Bolin, 1986; Bolin and Stanford, 1998; Peacock et al., 1997; Cutter, 1995; Enarson and Morrow, 1998).

The evolving process is handed over by local actors when the social, political, economic and scientific conditions become out of hand for the organizations. Jurisdictional and disciplinary boundaries need to be coordinated and integrated in order to manage the hazard reduction processes. The critical aspects of the jurisdictions and organizations need to be thoroughly analysed in terms of identification and monitoring in order to carry out thorough disaster reduction and reduce those occurrences which actually cause the disaster. These are mostly those decisions which have been accepted socially by the various society groups and have the ability to manage the different risk levels. An interactive process of discovery is carried out. The behaviours of others is followed by groups changing their activities or practices. The behaviour is now attributed towards achieving short term economic benefit but causes long term environmental degradation. The objective of the organizations must be to carry out processes that are constructive rather than destructive. The hazards must be reduced through elective means and dependent relationships that exist amongst the organizations or multiple groups.

Effectively the sustainability based process introduced in this study suggests that managing fire hazards is not straightforward from a national or policy making perspective. A number of potential drivers ranging from general ones like management and governance to culture specific ones like tribalism emerged in this study and ideally to take the study forward each driver needs a committed investigation to explore operational issues. Other studies in other countries may reveal different degrees or variations in the themes which have emerged. A sustainability based approach however indicates the evolving nature of disasters as disaster relief does not end with the disaster but pre disaster management through education and post disaster management through effective burn centres for instance

is also critical and these pre and post disaster issues are also present in this framework. Furthermore the framework also takes into consideration the overriding role of mediators, namely knowledge and information technology in harnessing the effect of the drivers on overall sustainability.

CHAPTER FIVE: RECOMMENDATIONS, LIMITATIONS AND CONCLUSION.

This chapter provides an outline of the limitations and recommendations of this study. Clearly no study is perfect and this study is not without its limitations. These will be reviewed in this chapter. Furthermore the scope for further research to develop this study will also be highlighted. Managerial level recommendations have been integrated within the discussion and findings in the previous chapter. This chapter will focus on research based recommendations for future scholars interested in developing the themes raised in this study going forward. As such, this study is only an initial stepping stone in a vital area and hopefully this study can motivate others to develop our understanding of how to effectively manage fire based hazard and risk, globally and within the Kingdom of Saudi Arabia.

5.1 LIMITATIONS

Each and every study conducted contains of limitations. The same is the case with this investigation. Similar to other qualitative and inductive studies, the present results cannot be generalised. The study has only taken into account the managers of Saudi Arabia as a cross sectional sample. Hence, all perceptions and attitudes would not be the same in the case of similar context managers who are in other nations, or different-context managers in the same nation. Therefore managers dealing with other disaster contexts in Saudi such as flood relief may not report the same findings, and nor may managers in fire hazard in other countries. Despite this

potential difference, there is likely to be considerable overlap, but the exact structure of findings may differ.

The dynamics present in a specific nation influence the managers who experience them. There are usually the socio cultural specific structural parameters responsible for shaping and defining the experience of managers and policy makers within any macro environment and therefore differences may emerge. Also, managers who have a different context within Saudi Arabia like flood or national disaster events would present similar sentiments but are subjected to specific issues which may not be present in this study. Hence, it is not possible to generalise the results to other contexts.

The epistemology of the study taken into account by the researcher is the second key limitation present. The researchers interviewing style would be different from a secondary researcher's own style exploring the same context. Objectivity for the two researchers may be provided by an interview guide that covers the same issues and training could be provided to overcome this difference to some extent. Therefore the required amount of flexibility can be attained from the semi-structured guide which allows two different researchers to apply their contrasting styles and attain the required responses for the informants. However, it must also be noted that the responses presented by the informants are highly affected by the different level of rapport and trust that exists between the two parties. Within the same interview protocol, the content of one dataset could be different from another. 2 pilot interviews were conducted by the researcher in order to overcome the issue of validity. The interview guide's nature as well as the deviation points from the required questions could be understood through the pilot phase. After this understanding, an

appropriate structure was presented which would help make sure that the interview guide did not consist of deviances and no irrelevant topic arose during the actual interviews process. Furthermore, this study is based on one group of stakeholders, key informants, but does not explore the public's perceptions towards fire safety or even other important groups like emergency medicine departments for their views on how to reduce incidence of fire risk in Saudi Arabia.

The interviewer is employed at the Civil Defence Authority, which is why he is able to gain access to high priority individuals like senior trainers, instructors, regional level fire chiefs and national level managers. These high value keynote informants need to be dealt with in a skilled and experienced manner, which the interviewer is able to utilise. Outside researchers may find it difficult to deal with the senior managers of Saudi Arabia as there exists a high power distance amongst the individuals, as well as a high symbolism context, and the body language cues are also very different.

However, the interviewer believes that with the help of his methodology it has been made possible to extract the rich responses from the sample. Several advantages have been observed by the researcher, but there are also some limitations which are also associated with the style of interview. Within the research study, there was no use of projective techniques and the direct format of questioning was adopted. Usually, individual level manager based research often makes use of projective techniques and it is considered appropriate for use with key informants.

The projective approaches and elicitation however, need proper training and skills to be applied which is why the managers who desire implementation must be well equipped with these characteristics. However, unfortunately, it has been

observed that the researcher is not well equipped and would not be able to conduct such approaches. This aspect was understood during the pilot phase with the informants. There exists a high power distance within the Saudi culture and this may be the serious issue. The individuals who are low in the social hierarchy would have less control over situations. A PhD researcher would not be able to extract thorough information from the semi-conscious mind of the informants, as they would not be comfortable in opening up entirely.

A one third rule has been adopted that if at least one third of the informants are able to provide responses, the emergent theme would be included within the sample. Such an inclusion is common when inductive query is present (see Strauss and Corbin, 2004) but it is not the only system which may be used for inductively derived information. Therefore, some themes which are cited by informants would not be integrated into the framework due to their low prevalence within the responses, but they may still be important to a certain level. Therefore, study's framework only integrates the core themes which emerges from the sample, and not all of them.

During the analysis process, notes are made and these notes can be stored with the help of a computational thematic analysis approach. Presently, the manual approach is being used even though this method could lose, miss or misplace the data during the entire cycle of collecting data. Another issue that was present while the interview was being conducted was that many of the informants did not allow recording during the process. The analyst was now limited for his information collection as he needed to remember everything and note it down during and the process was conducted. 3 informants allowed the recording within the

premises of their workplace and in the presence of the informants' secretary. The degree of analysis upon each data set would be highly affected even if the informants present a slight variation in the confidentiality and anonymity.

A case study approach or real data adoption has not been carried out in the present report. By conducting this level of analysis, it would be possible to gain stronger insight upon the topic. Usually, interview data is criticised as being unable to capture real life situations. Positivist researchers usually present this issue, as they believe that the researchers are unable to convert the perceptions and views of the managers into the real life situations.

The present study is limited in several ways and the researcher must not generalise the findings across all Saudi managers or then managers in other nations within the same context. In the following section, some of the recommendations have been presented for the limitations identified. All studies are integrated with limitations and the researcher states that the above mentioned ones are not the complete list for potential issues in the research project. Future research recommendations have been presented in the following section and the managerial recommendations have already been stated.

5.2 RECOMMENDATIONS FOR FURTHER RESEARCH

Several means have been presented through which this study can be enhanced. First, it is possible to present a quantitative phase to validate the framework. By conducting a survey of a large sample of firefighters the conceptual framework and its validity can be confirmed or otherwise. This would help present a comparison between how policy makers and senior management conceptualise fire

hazard management with employees on the ground. Furthermore, a longitudinal study would be much more effective in revealing if the government initiatives towards fire safety management have had an effect or not, by also factoring in incidences of fire and correlating with other relevant factors such as geodemographics. A survey involving the public could also further enrich our understanding of the effectiveness of the themes in this study's framework. A wide gap between ground operatives or firefighters, the public and senior management could reveal important gaps in our understanding of how to introduce interventions designed to tackle fire safety at a national level. Such comprehensive and systematic research has not been done for any fire safety context in any country and represents an important avenue for further research and dramatically improving our knowledge base and understanding of national level fire safety management.

The type of questions may also be changed to help conduct inductive studies. Projective techniques have the ability to extract rich responses from the managers. Picture based or word association based projective elicitation would help uncover the themes that are trying to follow and it could be the alternative approach for direct questioning. Upon members of the public, ground fire fighters and even senior managers, an indirect approach-questioning format would present a much more valid study for comparison as well as for the methodological innovation and contribution. At present, the traditional grounded theory based research has been used in this study. When there is grounded based research, further deliberation is possible along with data set deconstruction and reconstruction. When grounded theory states limits for the grounded theorist, the themes and sub themes can no longer be saturated. However, it would be possible to add emotional sentiments or use metaphors for the analysis. Even though this is not the basic aim of the research

but it is possible to incorporate it within the research as the dataset is still open to further query.

The different levels of experience and the managerial personality role for instance were not included. The response would also be affected by the type of tasks the managers are engaged in. An essential managerial construct is the managerial personality, which affects their decision-making abilities. By analysing this aspect, it would be possible to attain information regarding the nature of their responses as would for instance assessing emotional intelligence. Therefore, for further research, fire safety must be analysed using qualitative or inductively derived innovative studies and incorporating psychology based constructs seem to be attractive.

The role of Saudi Ulema, tribalism or 'wasitha' or other important culturally defining issues in the Kingdom of Saudi Arabia, such as the impact of Royal decree on decision making affecting the public, were not raised as core issues, which is why they have not been discussed as part of this report. Some aspects such as tribalism however were raised and these have been discussed under governance, but each theme explored in the model could form a standalone study in its own right. Therefore, a separate study examining good management or information and communication technology or public education could form separate detailed discussions and investigations. These more detailed studies could add to our knowledge of how to effectively operationalise these practically. The aspects discussed should be able to give a basis for further research.

The above-mentioned recommendations are incomplete and not an exhaustive list. However, only a subset has been presented for further research inquiries that may be conducted.

5.3 CONCLUSION.

This study develops a sustainability based framework for the national management of fire risk and hazards. The main outcome is conceptualised as sustainability and the key drivers of this are conceptualised as management, regulation, governance and knowledge. However, in order for these to have maximum impact on developing a long term or sustainable pathways, information and communication technology as well as public education could play a strong mediating role. This mediating role of ICT and public education has not been highlighted in previous studies but is considered essential since if the public becomes more educated regarding fire hazards and risk then incidences of fire can change, which in turn would impact on the need for the drivers of sustainability. Similarly, if uptake of technology can accelerate practice of innovations then again this would change the pace with which the drivers have an impact on sustainability. This framework is the first known to the study author to generate a national framework for managing fire hazards, and thus represents an important landmark study, not only for the Kingdom of Saudi Arabia but also generally in the literature.

Further implementing this framework and using each of the framework dimensions as a management issue would help policy makers to implement change at the ground level and effectively curbing fire incidences. Therefore, each of the dimensions represents an important management agenda to focus on. The overall

focus on sustainability also emphasises that fire service design policy makers all across the world must factor in the proactive and long term, rather than focus on short to medium term reactive changes. This is important to foster long term changes in society and foster the seeds in Saudi society to create a long term solution to fire safety. Indeed, the Civil Defence Authority has announced to the investigator that five additional PhDs will be invested in as a result of the framework generated to focus on individual dimensions. This shows the social impact of this study and therefore its contribution. This study concludes on this positive note of contribution in shaping the reality on the ground for the people of the Kingdom of Saudi Arabia. The potential of this study to save lives in the future has made this effort sustainable in itself.

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